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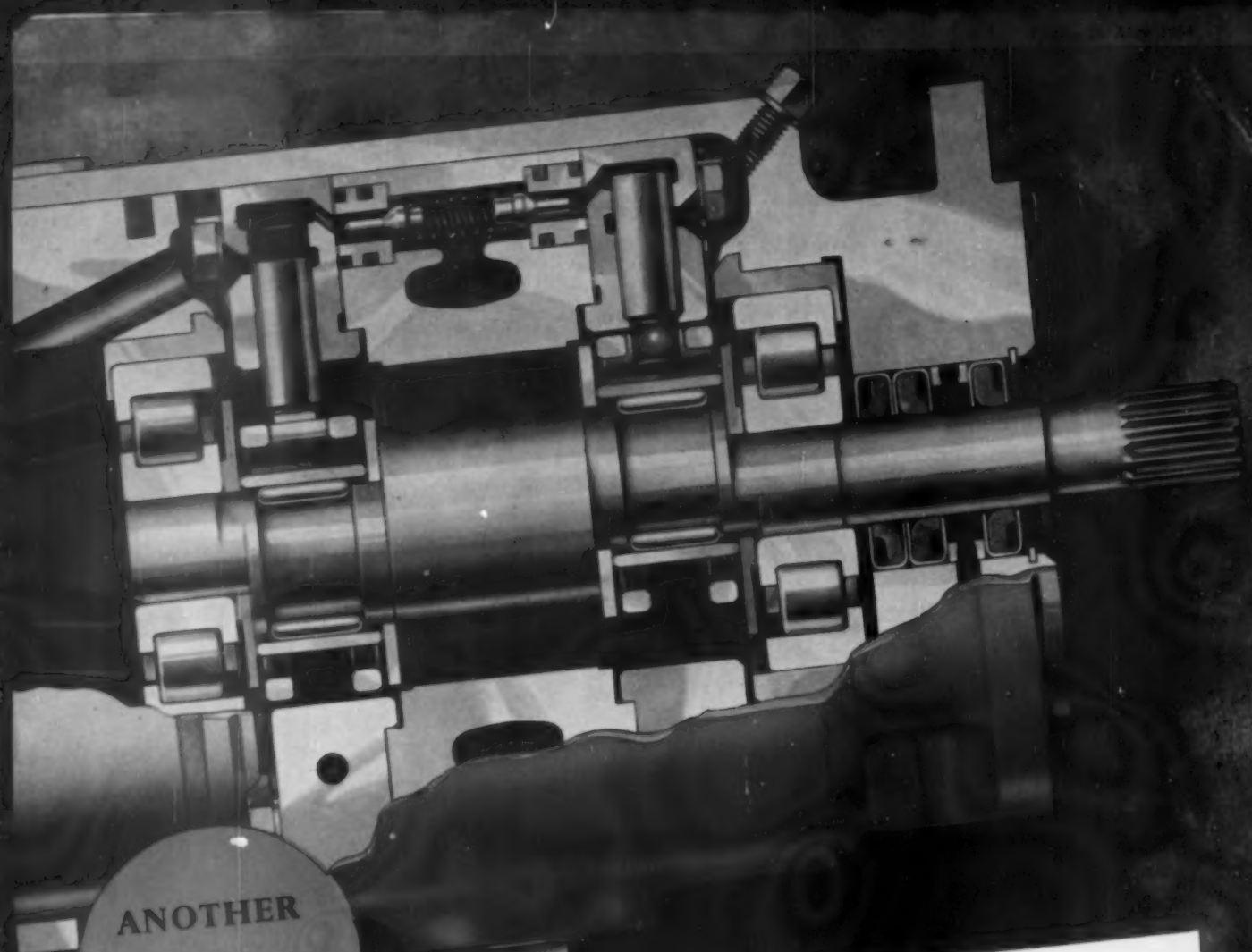

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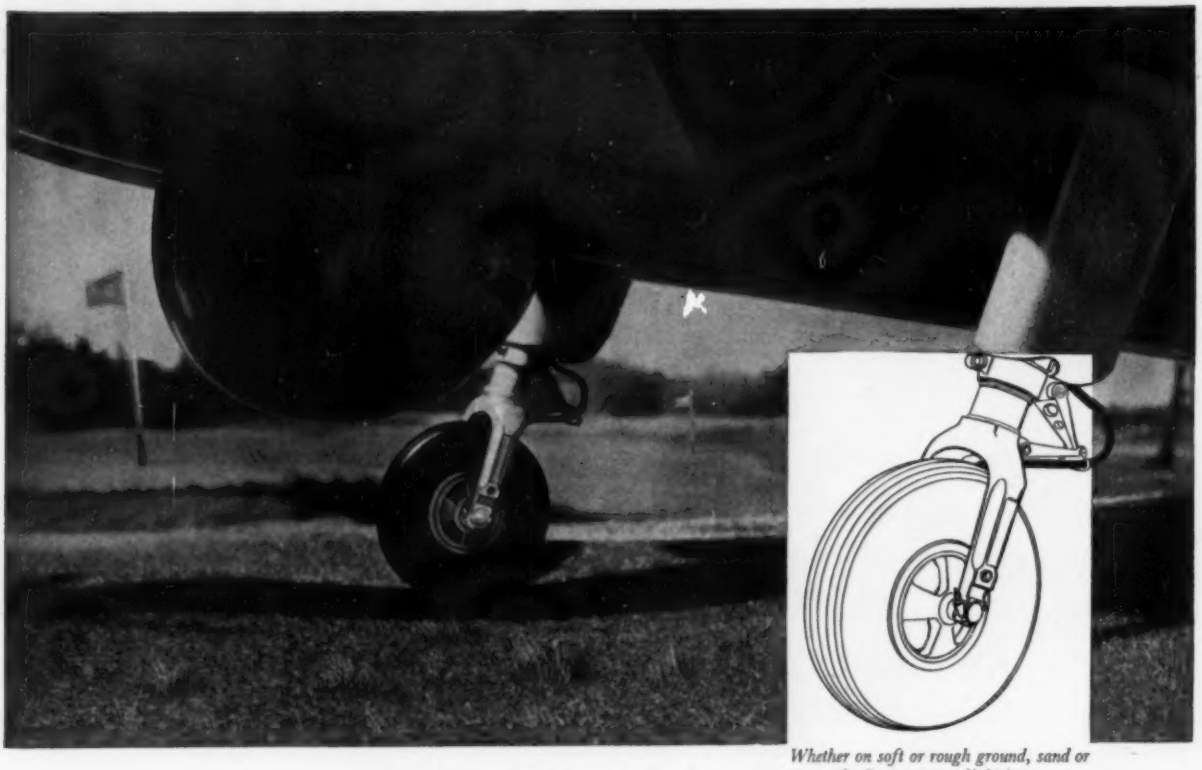

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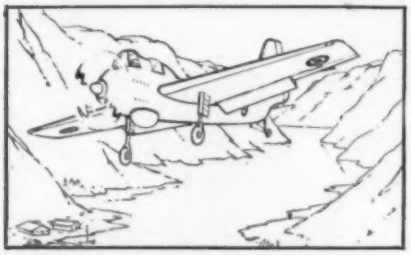

The extremely good handling characteristics of the Seamew combined with simplicity of construction and clear vision make it an excellent aircraft to fly, even for pilots with little experience of this type.

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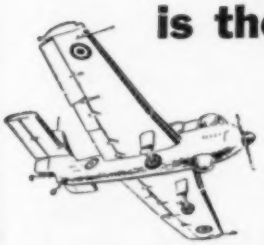

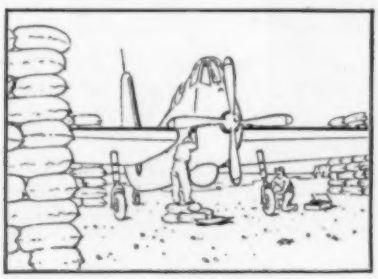

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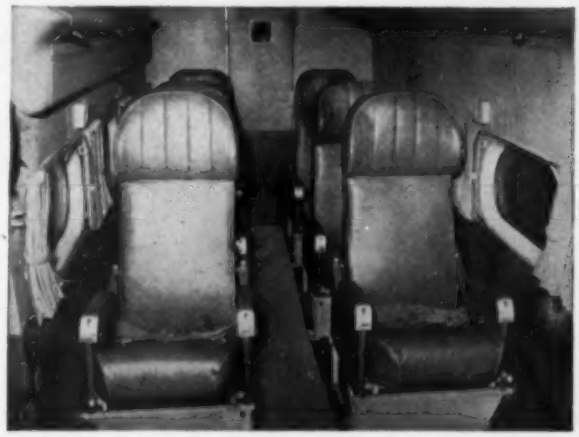

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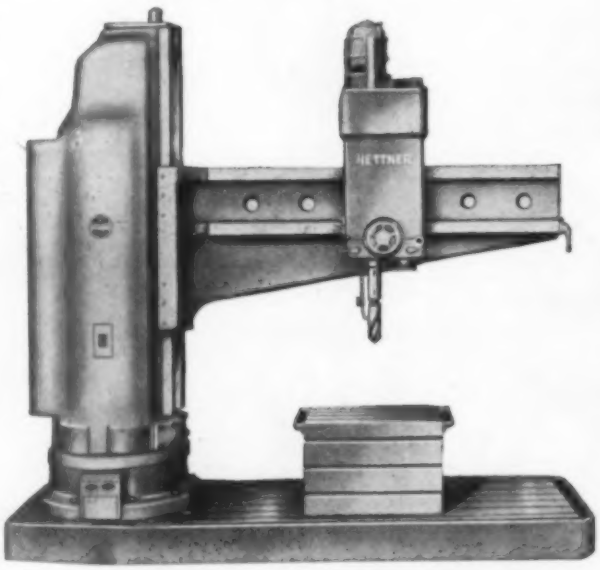

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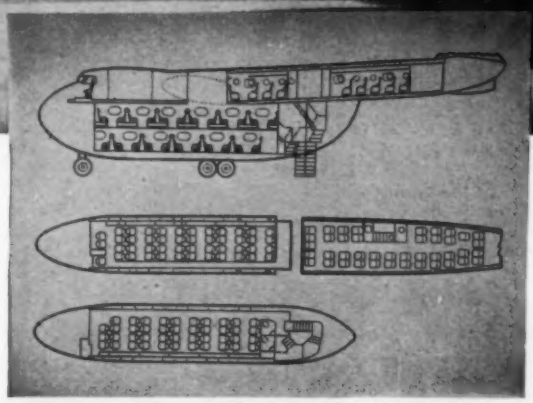

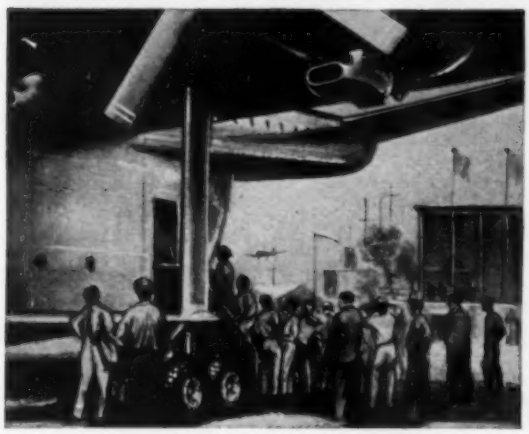

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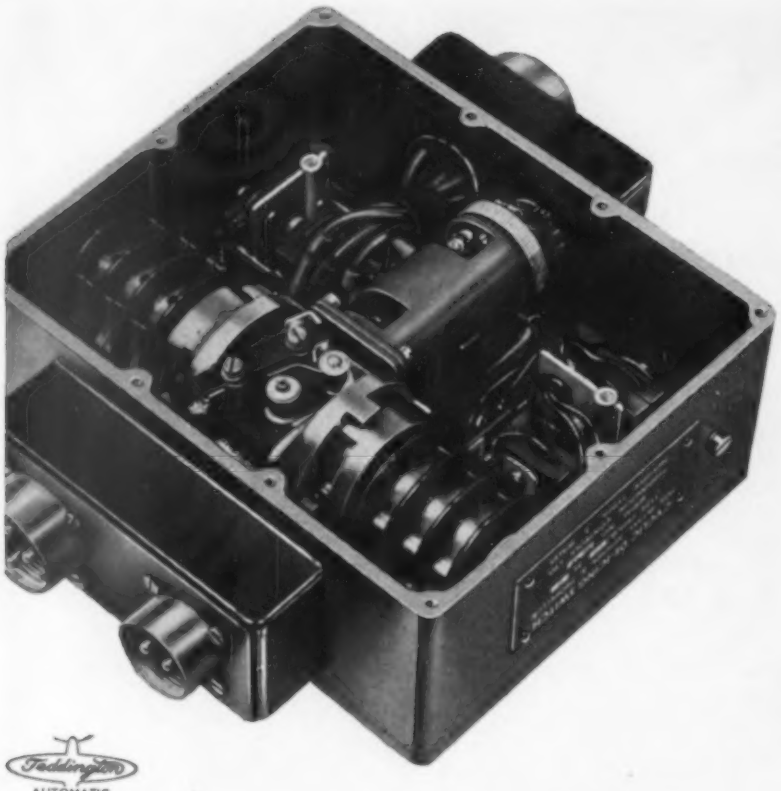

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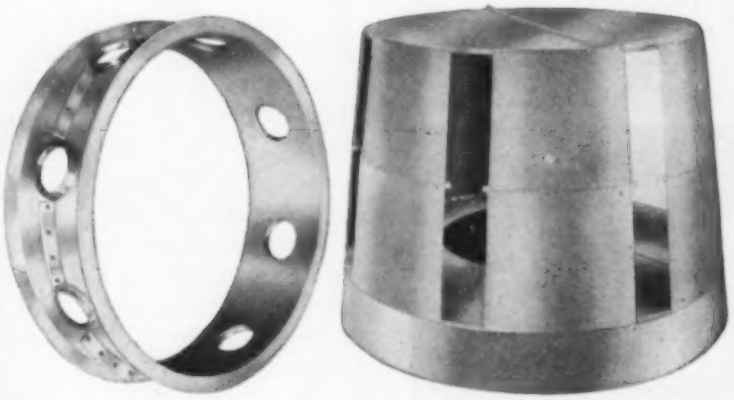

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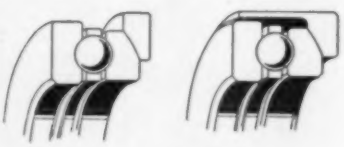

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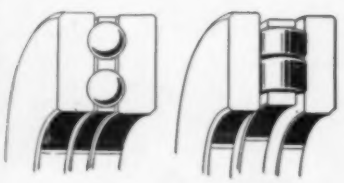

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and
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Good Pull-up for Airmen 707

Scale of Effort

ONE of the things that most impresses a foreign visitor to the American aircraft industry—or, in fact, to America itself—is the scale of thought and action. The various states of that huge country naturally differ to a marked extent in climate, customs and interest; but the American approach—on the grand scale—is to be found everywhere within the nation's boundaries.

In an article this week (pages 697-699) describing the first American jet transport we mention that the makers have a payroll of more than 70,000. This is but one of several companies of comparable size. Such numbers are not wholly concerned with design and production; in fact it is the magnitude of, for example, the research and sales effort that may appear more formidable to countries competing with America. We in England, (working largely on a cost-plus basis) have no call to compete on equal terms in the diversity of military designs nor in the numbers of each ordered; but our sales departments, whose relative strengths are perhaps in the ratio of 1 to 10 at best, do need to compete on equal terms in the world markets for civil aircraft, and for some military ones as well. Product-quality is, of course, of first importance. After this comes salesmanship. The numbers of men working outside and of those backing them up in the sales department count for a great deal, because there is no reason to suppose that British salesmen are better than their American counterparts—in fact, they are often less experienced and more restricted in their activities.

The hopes of the British industry continue to depend upon quality and timing. Of necessity we provide a smaller choice, but what we do offer must be of the best.

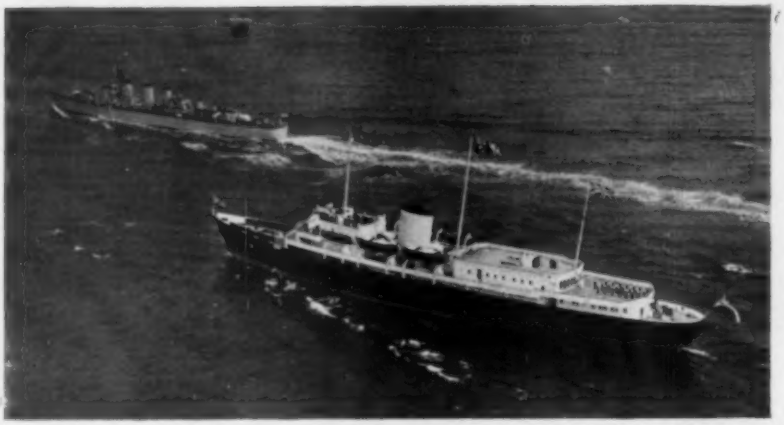
Fortunately Britain has been blessed with more than its quota of first-class technical brains, and our aircraft industry has through the years shown a remarkable ability to set the pace and breed winners. Now, more than at any other time, it is the brilliant few at the top who count. No amount of manpower or tooling can produce good aircraft unless the design is well conceived and well timed in the first place. Moreover, to guess wrong today may be to put one's company out of the running for three to five years.

This brings us back to the matter of research—of the men engaged upon it and of the equipment and money available to them. All three items are scarce. Fortunately, unlike salesmanship, the results of research in each country are remarkably freely circulated and each constructor is able to profit considerably and in good time from work elsewhere. While this country, like all others, is heavily outweighted by America in the magnitude of research effort (and, in the broader sense, American factories have research departments for which the British manufacturer has no counterpart at all) this does not necessarily mean that we are at a dangerous disadvantage. Nor, on the other hand, should it be supposed that this extra American effort, in such vast organizations, is superfluous—far from it. In a different context we may add that the information provided by research is of little value unless it is intelligently interpreted to improve the product or design. The same may be said of user experience.

Listening to Mr. Lennox-Boyd speaking last week in "another" capacity as Minister of Transport left us pondering on just this subject. He was opening a new automobile research establishment sited on a disused airfield at Lindley, near Nuneaton. If various people in several countries abroad are to be believed, British motor-vehicle manufacturers do not always take sufficient notice of experience and advice from overseas. In fact a good deal of the information they expect to gain from the artificial rough road surfaces laid at Lindley has, one is told, already been given to them during the last five years—and largely ignored. To our knowledge, the alleged inadequacy of suspensions, engine bearers and ground clearance, not to mention spares provisioning, has been a perennial subject of complaint since 1947.

These matters are of no direct concern to aircraft people; but whether such comments be justified or not, we cannot help observing that, should the aircraft industry show signs of concentrating on the home market to the exclusion of requirements abroad, it would be a bad day indeed. To go further, it could be said that should we, through false pride or for other reasons, fail to profit as fully as is possible from knowledge and experience gained abroad, then that would be near suicidal. Fortunately there has been no more than an occasional isolated example of such a shortcoming, and so we still more than hold our own against truly formidable rivals.

FROM ALL QUARTERS



ROYAL RETURN: This fine impression of "Britannia" approaching the Needles, with one of the Royal Navy's fast minelayers in attendance, was secured by Gloster Aircraft photographer Russell Adams. On this occasion he was flying in the Duke of Edinburgh's Devon, with F/L. Caryl Gordon as pilot. On "Britannia's" after-deck, where a band is seen lined up, there is space for helicopter landings.

Boeing Setback

LAST Saturday—after the article on pages 697-9 had gone to press—Boeing's new Stratotanker jet-transport prototype suffered a most disappointing occurrence. The aircraft was rolling gently along a runway at Renton, with engines idling and flaps at the take-off setting, when the port main undercarriage leg tore away from its mounting. As the photograph shows, the aircraft heeled over on to the two port jet pods, the offending leg pushing its way up through the wing and the rear bogie wheels severely damaging the inner flap section. According to a bystander, "she just flopped down; most of us couldn't believe our eyes at first."

Later, the Stratotanker was jacked up and towed back to its workshop hangar, where repairs are no doubt proceeding apace. According to Boeing no structural harm was done—which can probably be interpreted as meaning that the wing spars and pods are still sound. There does not appear to have been any leakage from the integral wing-tankage. Nevertheless, it is certain that the aircraft will not fly for a considerable time—Boeing put it at "several weeks." Had the accident occurred at higher speed it is possible that very serious damage would have ensued from destruction of the port turbojets—a point against the pod mounting.

The actual failure appears to have been in the local structure surrounding the leg attachment, for some of this structure seems to have been forced upwards while still attached to the leg. The leg came to rest in such a position as to indicate that it was still held by the main radius-rod.

No official pronouncement regarding the cause of the mishap had been made by Tuesday of this week; major errors in stressing are almost unthinkable, and yet defective material or incorrect assembly is, in a vitally important prototype, no more likely. Whatever the cause, the indignity inseparable from such a collapse has dealt a hard knock at the great Boeing company. But, competitors or not, it is to be hoped that they will shortly be able to wheel the chocolate-and-cream prototype into the open once more.

Testing the Comet 1

THERE has never been any aeronautical investigation like that now being conducted on five de Havilland Comet 1s. All the resources of the constructor, the operator, the M.o.S., the M.T.C.A. and the A.R.B. are being applied to a most searching examination of this aircraft type, in order to clear up the mystery of three disasters, and then to render the Comet 1s suitable for resumption of services and finally to clear the way for operations with Series 2 and 3 Comets.

Possibly the most important tests are being conducted on G-ANAV, the Comet purchased by B.O.A.C. from C.P.A. This aircraft has been turned into a very fully equipped laboratory, and the airframe is extensively strain-gauged, the electrical signals being remotely recorded (an obvious technique would be immediate telemetering of such values for analysis on the ground). The fuselage of AV has several panels of direct-reading instruments, all of which are continuously photographed in flight by shock- and fire-proof cameras. Pressurization is not in use, and the test crew use oxygen masks. Continuous radio contact is maintained throughout testing, a wire recorder being employed. Ballast is carried to make up a representative load.

The aircraft is being flown from the R.A.E. Farnborough by a Service (M.o.S.) crew: S/L. R. L. Topp, A.F.C., F/L. R. J. Ross, F/L. A. W. F. Burge and F/L. W. K. Owen, A.F.C., D.F.M., the two last-mentioned officers being flight engineers. The Comet was ferried across from London Airport to Farnborough last Monday by Peter Bois de Havilland who, with the company's chief test pilot, John Cunningham, is also taking part in the tests.

Other Comets, all owned by B.O.A.C., being examined are: G-ALYS, which is undergoing structural investigation at R.A.E.; G-ALYU, which has been partially dismantled for fuselage pressure tests in the R.A.E.'s large water tank; and G-ALYX, which is being used at Hatfield for experiments on the integral tankage, using fuel coloured with a vivid dye. G-ALVG has been at R.A.E. since August for fatigue testing.

Slight Fall in Exports

FIGURES issued last week for British aviation exports, covering the first quarter of 1954, amount to a value of £16,194,587. The March total was £5,539,203, which shows a slight fall in relation to the monthly average over the previous twelve months, which was £5,576,681.

The annual rate, as indicated by the total for the first quarter of this year, is running at £64,778,340, as against the total for 1953 of just over £65 million.

Those Unidentified Objects

"NINETY per cent imagination, with the remainder unexplainable." This is the verdict of General Twining, U.S.A.F. Chief of Staff, on reports of what are popularly and generically known as flying saucers. His view, in our own estimation, is an eminently sound and balanced one.

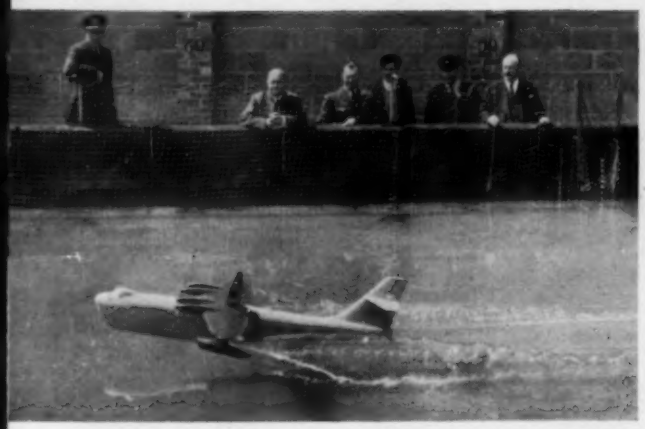
The Chief of Staff went on to say—he was speaking at Amarillo, Texas, last week—that America's best brains were working on the problem. "We just don't know about that ten per cent," he said. "If they are from Mars and there is a people and a world that far ahead of us, I don't think we even have to worry about it."

"Some very reliable people" had reported objects that could not be identified, and all these reports could not be discounted.

G-AMRK

THE aircraft bearing this registration is already an affectionately regarded member of the British air-sporting scene. At present the only serviceable Gloster Gladiator on the British civil register (if not in the world), she owes her existence largely to the efforts

BROKEN BOEING: As related above, the prototype Boeing Stratotanker suffered a collapse of the main port undercarriage last Saturday, during taxying trials at Renton. This photograph shows that the leg and rear bogie wheels have caused severe local damage to the wing and flaps.



VISITORS TO COWES: (Left) A Saunders-Roe long-range patrol flying boat (others were illustrated in "Flight" of February 26th and March 19th) under test in the company's free-alighting tank; the lookers-on include Air Marshal C. R. Slemon, R.C.A.F. Chief of Air Staff; A. Cdre. M. Costello, Air Member, Canadian Joint Staff; A.V-M. D. V. Carnegie, until recently R.N.Z.A.F. Chief of Air Staff; Mr. R. V. Perfect (director) and Mr. W. A. Crago. (Right) Mr. Profumo, Parliamentary Secretary, M.T.C.A., inspects the Princess flight engineer's panel in company with Capt. E. D. Clarke, managing director (nearest camera) and Sir George Cribbett, Deputy Secretary, M.T.C.A. Does this portend a last-minute reprieve?

of Mr. V. H. Bellamy, an ex-Fleet Air Arm pilot. As we reported on January 25th and June 20th, 1952, Mr. Bellamy came across two Gladiators at Hamble and, with considerable assistance from the British industry, turned them into one good aircraft which was shortly granted a full C. of A. The two had originally been built as N 5903 and L 8032 (the former, at least, being a Sea Gladiator, and the latter the last Gladiator of the 527 that were constructed).

Last autumn, Mr. Bellamy sold AMRK to its makers, the Gloster Aircraft Company, who probably have the best facilities for keeping it in flying condition. Its next public appearance is scheduled for tomorrow, May 29th, at the R.A.F.A. display at Staverton Airport, mid-way between Gloucester and Cheltenham. The pilot on this occasion will be Geoff Worrall.

Air News on the Air

FOLLOWING a visit to Britain by Mr. Rasmus Hansen, Denmark's Defence Minister, the reorganization of the Danish Air Force is being discussed. One report says that 120 instructors —presumably technical—may come from Britain, and that a British adviser is being sought; the name of Air Chief Marshal Sir Hugh Saunders, who retired from the R.A.F. last year, is mentioned in this connection.

This news was given in a recent report by Copenhagen Radio, and is one of an unusually large number of stories, of varying degrees of aeronautical significance, that have been put out during the past two or three weeks by the broadcasting stations of various countries, both in Europe and farther afield. From them, in brief-note form, we quote the following:—

Unidentified jet aircraft sighted over Lapland are said to have been exchanging fire; Maj.-Gen. Valla, of the Frontier Guards staff, confirms that explosions have been heard, but says that it is impossible to state what caused them—(Helsinki Radio). R.A.A.F. aircraft from Australia's first permanent base on the Antarctic mainland, established early this year, have photographed nearly 500 miles of the Polar mainland—(Radio Australia).

The President of the Austrian Aero Club, commenting on the latest Soviet veto in the Allied Council on the setting-up of an Austrian air rescue service, said that Austrian airmen would not comply with this ban; rescue aircraft with foreign registrations would be stationed in Austria and flown by pilots with foreign licences—(Radio Austria). Over 1,000 pilots and 1,757 navigators from N.A.T.O. countries have received their training in Canada; nearly 1,000 others are now being trained, and Canada was prepared to train 1,200 aircrew for NATO during each of the next three years—(Hon. Mr. Brooke Claxton, Canadian Defence Minister, quoted by Columbia Broadcasting System). Hungarian State Airlines opened a new, direct air service between Budapest and Berlin on May 18th; hitherto, passengers from Budapest for Berlin had to change at Prague to Czechoslovak aircraft—(Budapest Radio).

A sufficient number of Hawker Hunters to form a full squadron for the Royal Danish Air Force will soon be purchased from Britain; they will replace Meteors, and will cost about £2,700,000 for 25 aircraft and spares; Denmark is also negotiating for Canadian-built Sabres—(Copenhagen Radio). The F.A.I. has confirmed as world parachute records the recent group-jump by five men, and another by a woman, from 7,421 m (24,347 ft) —(Moscow Radio).

SEA HAWK ABROAD: One of the Hawker Sea Hawks built by Armstrong Whitworths was recently flown to Lann-Bihoue, near Lorient, by test pilot Joe Lancaster for inspection by the French Navy, two of whose pilots flew it. In this group are, left to right, S/L. Lancaster, Capt. Hale, R.N. (British Naval Attaché), Cdr. Bozec (commanding Lann-Bihoue), Rear-Admiral Ruyssen, Eric Franklin (chief test pilot), Claud Emery (sales director) and Norman Wilson (service manager).

The Big Helicopter Order

LAST week we briefly recorded Mr. Duncan Sandys' announcement—made in the House of Commons shortly before we went to press—of a Ministry of Supply production order for "about 100 of a military version" of the Bristol 173 helicopter; we also quoted some of the figures given by the Minister concerning money spent on helicopter research.

It is now possible to give these figures in more detail. Mr. Sandys revealed them in a written reply to Mr. Holt (Lab., Bolton West). Though, as he said, it was not the practice to publish detailed figures showing the sub-division of sums voted for research and development, he recognized that there was considerable public interest in helicopters at this time, and he was satisfied that security in other fields would not be prejudiced by giving the required information. The sums paid by the Ministry, he said, were as follows:—

1945-46	Nil	1950-51	£192,000
1946-47	£115,000	1951-52	£289,000
1947-48	£180,000	1952-53	£573,000
1948-49	£127,000	1953-54 (estimated)	£1,256,000
1949-50	£280,000		

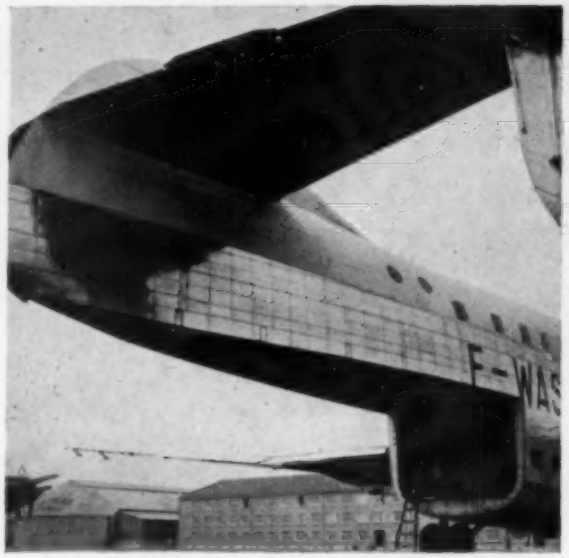
In the year 1954-55 expenditure was likely to increase to more than £2,500,000. From these figures it would be seen that the amount spent by the Government on helicopter development was

FROM ALL QUARTERS . . .

doubled in 1952, doubled again in 1953, and was being doubled once again this year. In addition, substantial research work was being undertaken in Ministry of Supply establishments.

The Minister made his announcement of the order of Bristol 173s in the course of another reply on the same occasion, and also mentioned that "a larger type with gas-turbine engines, capable of carrying 27 passengers," was being planned. He then went on briefly to review Fairey and Percival helicopter plans. The former company, he said, were developing a 40-seater of entirely novel design. Forward propulsion was to be provided by propellers whilst the vertical lift was provided by rotors powered by jet units at the tips. A small research helicopter incorporating these principles had been flying successfully for several months and a large-scale prototype was under construction. A third type of research helicopter was under construction by the Percival Company. This embodied another form of torqueless drive which might be applicable for civil passenger aircraft. Work on helicopters by all three firms was being extensively supported by development contracts from the Ministry of Supply.

Whereas the Minister's statement in regard to the Bristol 173 referred only to "a military version," the manufacturers have since said, more specifically, that the order is "for about 100 twin-engined, twin rotor helicopters for the Royal Navy and Royal Air Force, and one of the chief rôles for which the new Naval aircraft will be required is anti-submarine duty." It will be recalled that, last autumn, a successful series of deck-operation trials was carried out by one of the two prototype Bristol 173s from the carrier H.M.S. *Eagle*. The company says that further prototypes now being built will be used for intensive investigation into the operation of twin-engined helicopters for military and naval purposes. Like the existing commercial prototypes, they will have Alvis Leonides Majors. Alvis, Ltd., state that these engines will power the "100 order" announced in the Commons by the Minister.



DOING A BEVERLEY: As this photograph shows, the rear doors of the double-deck Bréguet 76-3 can be completely removed to enable the aircraft to drop heavy freight. A demonstration of heavy-cargo parachuting was staged on May 8th with the aircraft shown. At present all the big Bréguets are civil.

Edward Griffiths

ALL who knew him, at Armstrong Siddeley Motors and elsewhere, will be grieved to learn of the death of Eddie Griffiths, the company's chief test pilot. He was flying a Wyvern from Biteswell on May 18th and crashed in a field a few miles from the aerodrome, the aircraft being burned out. Formerly a Naval pilot, with the rank of lieutenant, Griffiths had received his flying training in America during the war, and had later flown Spitfires in the Middle East. Later he was on Fulmars and Fireflies, and much of his Naval flying experience was in connection with the development of night flying from carriers; he performed such duties on Fireflies in No. 1790 Squadron. After leaving the Service he joined A.S.M. as a technical assistant in November 1949 and became a test pilot in January 1951. In April last year he was appointed chief test pilot in succession to S/L. Devine, with three other pilots under him. His total of rather over 2,000 hours had been accumulated on 39 different types, 17 of which he had flown since joining the Coventry firm. Griffiths, who was 31 years of age, was particularly well liked by his colleagues. He leaves a widow and three children, with whom wide sympathy will be expressed.

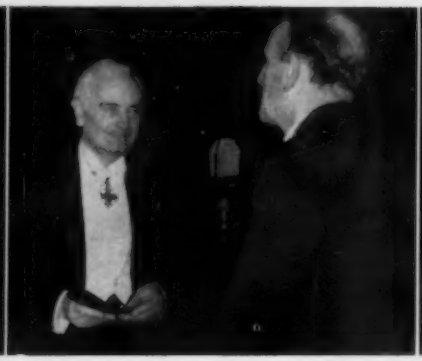
Eddie Griffiths.

R.Ae.S Fellowships

IN addition to its announcement of recipients of Honorary Fellowship Diplomas (presented last week, as recorded on the opposite page) the Royal Aeronautical Society has notified the names of 22 men—including a Canadian, an American and an Italian—elected as Fellows. The list, with the occupations of those concerned, is as follows:—

C. Abell, deputy operations director (engineering), B.O.A.C.—responsible for the maintenance, overhaul and engineering development of the Corporation's fleets; L. R. E. Appleton, chief engineer of the research and armament development division of the Fairey Aviation Co.; A. C. Campbell Orde, operations development director, B.O.A.C.; J. S. Clarke, research engineer in charge of Lucas combustion-research laboratories; C. L. Dann, Director (Air) British Joint Services Mission (Technical Service) Washington; J. T. Dyment, engineering superintendent, Trans-Canada Airlines; C. E. Fielding, works director, A. V. Roe and Co., Ltd.; Giuseppe Gabrielli, director of Fiat Societa (Torino) technical division; W. G. Glendinning, consultant to the Graviner Manufacturing Co.—Until retirement, worked particularly on aircraft fire problems at R.A.E.; Raoul Hafner, chief designer, helicopter division, Bristol Aeroplane Co.; W. S. Hemp, Professor of Aircraft Structures, College of Aeronautics, Cranfield; H. L. Hibbard, vice-president engineering, Lockheed Aircraft Corporation, U.S.A.; W. G. Jennings, Superintendent, Airborne Experiments, A.F.E.E.; W. P. Jones, Superintendent, Aerodynamics Division, N.P.L.; C. F. Joy, chief designer, Handley Page, Ltd.; W. A. Mair, Mond Professor, Cambridge University; E. B. Moss, technical director, Smith's Instruments, K.L.G. and Wayne Pump companies; Stefan Neumark, senior principal scientific officer working on aerodynamic research at R.A.E.; L. F. Nicholson, Head of the Aerodynamics Department, R.A.E.; W. A. Tamblin, chief designer, Airspeed division, de Havilland Aircraft Co.; H. C. B. Thomas, Head of Mechanical Engineering Department, R.A.E.; R. H. Woodall, director and chief engineer, Rotax, Ltd.

ANGLED: A revealing air view of the recently commissioned carrier H.M.S. "Centaur," the first of the Royal Navy's carriers to have the "angled" flight deck. She is 737ft. long, of 120ft beam, and carries a complement of 1,300 officers and men.



R.Ae.S. AWARDS PRESENTED

SUMMARIZED in last week's issue of *Flight* (and continued on pages 701-704 of this issue) is the paper *The Choice of Power Units for Civil Aeroplanes*, by Dr. A. E. Russell, a director and the chief designer of the Bristol Aeroplane Company's aircraft division. His survey, which has already taken its place as a work of the highest consequence and value, was read as the 42nd Wilbur Wright Memorial Lecture before the Royal Aeronautical Society, at the Royal Institution of Great Britain, on Thursday of last week.

Each year, the Wright Memorial Lecture is also the occasion upon which the Society's awards are presented, and on this occasion the chair was taken by the newly elected president, Sir Sydney Camm, a director and the chief designer of Hawker Aircraft, Ltd. He presented an Honorary Fellowship Diploma to Sir A. H. Roy Fedden, whose achievements—principally in the field of engine design—go back to the days before the First World War. (His notable paper given recently before the Society of Engineers, *A Century of Progress in Aeronautics*, was the subject of an abstract in our previous issue.) A similar Fellowship Diploma had also been awarded to Sir Frank Whittle, but he was unfortunately unable to be present to receive it. As the upper left photograph above shows, Sir Geoffrey Taylor, a scientist eminent in many fields, received the R.Ae.S. Gold Medal; and other major awards presented included the Society's Silver Medal (Prof. W. J. Duncan, Professor of Aeronautics and Fluid Mechanics, Glasgow University), the Society's Bronze Medal (Mr. H. B. Howard, Assistant Director of Research, Structures, M.o.S.), the British Gold Medal (Mr. A. G. Elliott, Rolls-Royce joint managing director and chief engineer), the British Silver Medal (W/C. R. A. C. Brie, of helicopter-development fame), the George Taylor (of Australia) Gold Medal (Capt. V. A. M. Hunt, Director of Control and Navigation, M.T.C.A.), and the Simms Gold Medal (Mr. E. D. Keen, Armstrong Whitworth Aircraft assistant chief designer). The different fields of aeronautical achievement which these awards are designed to recognize were detailed in the list given on page 603 of *Flight* for May 14th.

Above, Sir Sydney Camm is seen presenting awards to (l. to r.) Sir Geoffrey Taylor, Mr. A. G. Elliott, and Mr. H. B. Howard. The fourth photograph shows the recipient of the Musick Memorial Trophy, Sir B. Melvill Jones, with (left) the N.Z. Deputy High Commissioner.

"Flight" photographs

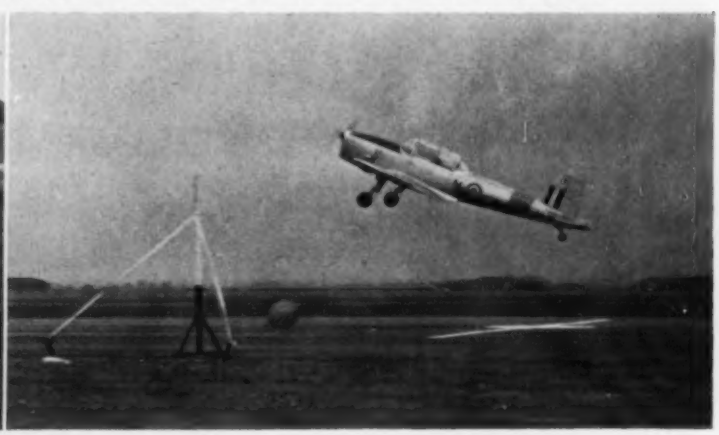
Another of the photographs above shows Sir Bennett Melvill Jones receiving the congratulations of the Deputy High Commissioner for New Zealand, Dr. R. M. Campbell; Sir Melvill was this year's recipient of the Musick Memorial Trophy, which is annually awarded by the Royal New Zealand Aero Club to "the group, body or person making the greatest contribution to aviation safety, with special reference to transoceanic flight." It was first awarded in 1939. No award was made between that date and 1951, and last year the Trophy went to the U.S.A. Sir Melvill, who was the first man to hold an aeronautical professorship in Great Britain, is now a consultant to the R.A.E.

CHIPMUNKS IN COMPETITION

THE flying contest for the de Havilland Trophy was held on May 15th at R.A.F. Station Hawarden between the University Air Squadrons of Birmingham, Liverpool and Manchester. The Trophy, which takes the form of a silver model Chipmunk, was given by the de Havilland Chester factory, which shares Hawarden Airfield with the R.A.F.

The tests set for the pilots included formation flying, aerobatics, and restricted landings and take-offs. The competition was judged by Mr. J. C. Corby, general manager of the de Havilland Chester factory, W/C. B. A. Fraser, Station Commander at Hawarden, and W/C. M. Kellett, D.F.C., Officer Commanding Nos. 610 and 611 Squadrons, R.Aux.A.F. The Trophy was won by the Birmingham University Air Squadron, with Liverpool second. Mrs. B. A. Fraser presented the Trophy. Mr. Corby, who announced the results, was introduced by A.Cdre. W. S. Hebden, C.O. of No. 63 (W. and W.) Group, R.A.F.

F/L. Thackeray receives the Trophy, on behalf of Birmingham University Air Squadron, from Mrs. B. A. Fraser. Looking on are Mr. J. C. Corby and A. Cdre. W. S. Hebden. (Right) One of the flying tests in the competition was to determine skill in restricted take-offs.



Fleet Air Arm Entertains 12,000 at Yeovilton

The three Fairey Gannets fly by with flaps, hooks and undercarriages up and with bomb doors and radomes down.

"Flight" photographs

AIR DISPLAY SEASON OPENS

THE first Naval air day of the year, held at Yeovilton (H.M.S. *Heron*) last Saturday, was a distinctly mixed bag. Aircraft manufacturers' support had been promised, but there were last-minute cancellations—some at the behest of the Ministry of Supply—and the weather put a truly wet blanket over the whole show.

Despite the threatening sky, however, the spectators began to stream in as soon as the gates opened at 12.30 p.m. Soon, in the static shows in the hangars, questions asked in Somerset's burr were being answered in Naval parlance.

There was plenty to be seen in the two hours between the opening of the gates and the starting of the flying programme. In No. 5 hangar, where the industry had been invited to display its products, Faireys were showing a set of models ranging from the F2 fighter of 1917 to the Gannet, F.D.1 and Rotodyne of the present day. A particularly fine model of the Flycatcher of 1923 brought back memories of the days of *Courageous* and *Glorious*, when the Flycatchers used to take off straight from the forward hangar and over the forecastle.

Bristols were showing their exquisitely finished sectioned Proteus encased in Perspex. This was very revealing, every detail being available for inspection. A non-sectioned Olympus was shown alongside.

Cheek-by-jowl with models of the Handley Page Victor and H.P.97 were models of the Nulli Secundus airship (1907) and a man-lifting kite as used by S. F. Cody.

Occupying the centre of the hangar were a complete A.S. Double Mamba, a sectioned Rolls-Royce Dart, a rocket device of extreme fineness-ratio (non-committally labelled "bifuel research test vehicle"), a very complete radar exhibition, a Rotax undercarriage actuator, a Martin-Baker ejection seat and a sectioned Bristol Theseus.

Alvis were showing both helicopter and fixed-wing Leonides in sectioned form and Dunlops demonstrated the Maxaret braking system: Westlands and Normalair, as the local inhabitants, had a joint stand; Westlands displayed a series of models and an exhibition rotor-head, and Normalair some of the multiplicity of instruments connected with cabin pressurization; these included the new Type D pressure-controller and discharge valve for the Comet 3.

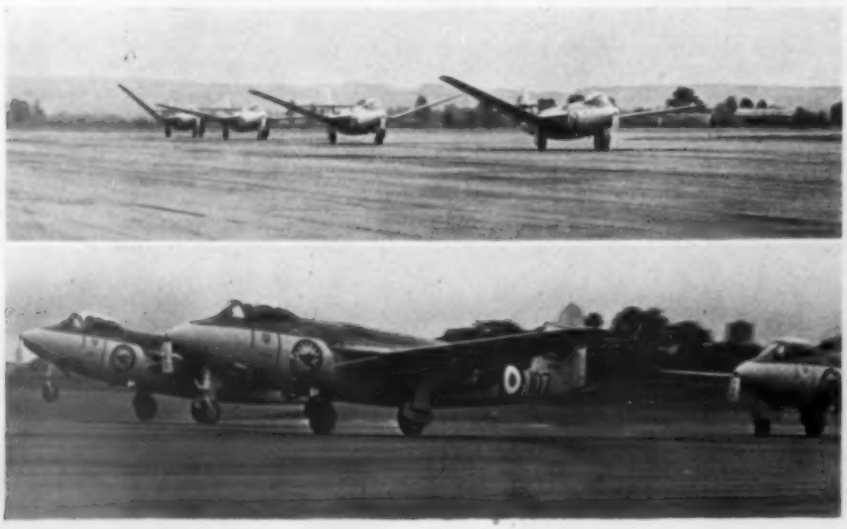
On the Vickers-Armstrongs stand a large and much-admired model of the Swift overshadowed smaller versions of the Attacker, Seagull, Seafire and 508. De Havillands showed the beautifully sectioned example of the Ghost, as displayed at Farnborough, and this was flanked by a sectioned Sprite, a model of the D.H.110 (as now being developed for the Navy) and a Hydromatic airscrew.

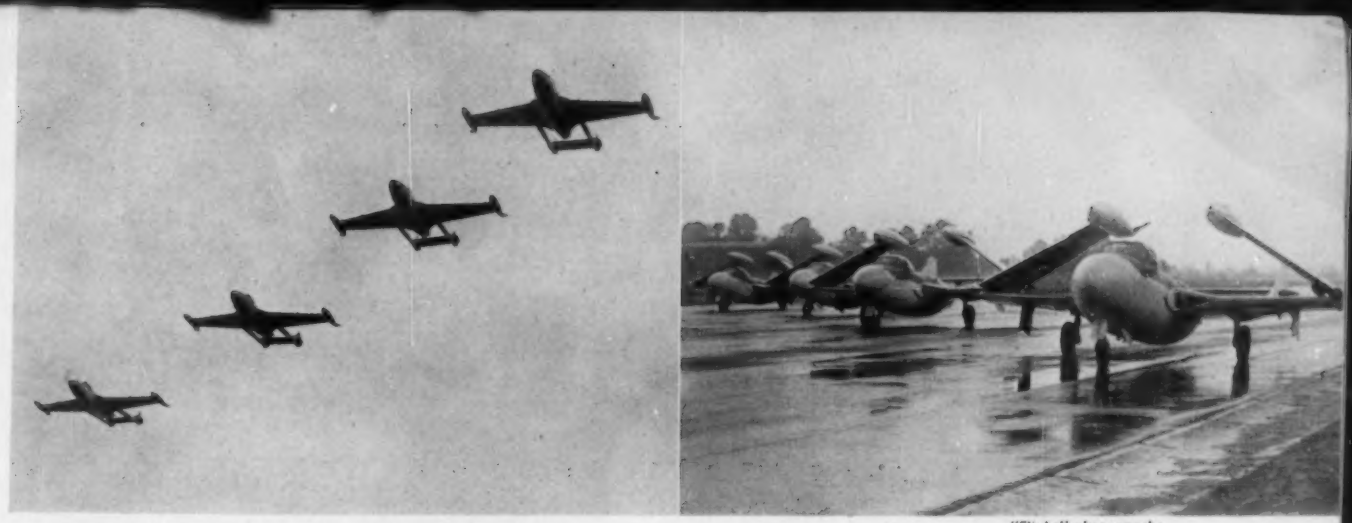
Perhaps the most interesting exhibition in the whole display, however, was the hitherto secret 30 mm Aden gun, which was on show with a clip of representative ammunition alongside its earlier 20 mm and 0.303in *confrères*.

The station exhibit in No. 6 Hangar included the huge model of H.M.S. *Triumph*—with aircraft ranged on deck—and five full-scale aircraft, the Wyvern S.4, Sea Fury FB.11, Seafire 17, Attacker FB.1 and Sea Venom FAW.20; the older types were stripped for inspection. Flanking the doors were a Skyraider AEW.1 (Airborne Early Warning) and a Percival Provost.

When the flying programme opened, Cdr. Lamb, the announcer, had some apologies to make for changes in, and absentees from, the programme. His first regret was the non-appearance of the Britannia. In connection with this aircraft he pointed out

The 898 Squadron Sea Hawk show, in three parts: Taxying down the runway while lowering wings; take-off down wind in vic with "one in the box"; and a low slow roll in front of the crowd in the same formation.





"Flight" photographs

No. 890 Squadron Sea Venoms in the rain. (Left) A nicely spaced echelon to starboard. (Right) Taxying in with wings folded after the event.

that "the Services are playing with a version which will stay in the air for a day-and-a-half carrying three crews." The second item on the programme, the Vulcan, was also a non-starter; but the 707C, in the hands of Lt-Cdr. W. Stewart, very ably and nimbly upheld the name of Avro. How beautifully the 707C rolls!

The Fairey Swordfish, now a museum-piece, next took the air in its staid stride, using little of Yeovilton's 2,500 yd runway. For those who knew this aircraft Lt. Shepherd's show was full of interest; but for the populace at large it must have appeared as merely a quiet spot between jets.

Item 3 was a demonstration of formation aerobatics by four Sea Hawks from No. 898 Squadron (Lt-Cdr. D. Parker) but their start was preceded by S/L. Topp leaving in his Canberra for a later event; he took off with dive brakes out. The Sea Hawks taxied gently down the runway, lowering their wings as they went. At the end they turned and took off in formation down-wind. This event undoubtedly stole the afternoon. Despite low cloud and poor visibility their aerobatics were perfect, station-keeping in the slow rolls being quite exceptional. For the individual exhibition the four Sea Hawks came in as if to land, the first three overshooting and Lt. "Baldy" Kelly, who was in the "box," actually touching down. At the end of his landing run he turned and made another down-wind take-off to start his solo show.

Lt. Kelly's sense of showmanship is equal to his piloting ability; whether he was doing one of his vertical climbs or one of his equally vertical descents he was always just in the right place in the sky for all to see. Approaching from the left, he flew a perfect slow roll at about 300ft and returned from the right to execute a hesitation roll of equal precision at the same height. Returning once more, he remained inverted even lower for something over ten seconds. Some of his tight turns were a sight to watch. Cdr. Lamb told the spectators that both No. 898 Squadron and No. 810 Squadron (later performers at the display) would embark next September in H.M.S. *Centaur*, the new angled-deck carrier.

Peter Moore's demonstration of the Bristol 171 helicopter which followed was obviously a less spectacular event. But he showed off the Sycamore to its best advantage, finishing with an engine-off landing, in which the period from the beginning of the flare-out to the actual touch-down lasted some eight seconds.

As Moore tucked himself back in the aircraft park S/L. Topp on the Canberra came back to give his show. He was taking the place of Mike Lithgow on the Supermarine Swift—another non-arrival. By this time the weather had really closed in—rain was pouring from ragged grey clouds—but Topp went on to display the Canberra in the manner we have been taught by Beamont to expect. The high-speed runs and low slow rolls were more appropriate to a fighter.

The item following the Canberra was to have been a demonstration formation by Wyverns of No. 813 Squadron (Lt-Cdr. C. E. Price) but these having been grounded—for a matter of a few hours only, we understand—their place was taken by the Sea Furies of No. 810 Squadron (Lt-Cdr. Abrahams) from Ford. The flying was very polished but rather anti-climactic by comparison with that of the newer types.

A demonstration of three Gannets, led by Lt-Cdr. F. E. Cowtan, was more informative than exciting. They arrived low over the airfield, using the single-engined technique for their Double Mambas, then returned with both airscrews running, bomb doors open and radomes down. Their third and last run was with wheels, flaps and hooks down.

Some people elsewhere in Somerset were startled by a loud bang—probably blaming it on the weather—but the spectators heard not a sound of F/L. Cinnamon on a R.C.A.F. Sabre from North Luffenham who had gone to great heights above the clouds to go through the sonic barrier. When, however, he returned to visible level—with black smoke streaming from the efflux—he put the show nicely back on a modern high-speed footing. In the small (or comparatively so) space available below cloud he showed to advantage his 7,500ft/min (*vide* announcer) rate of climb. Incidentally, a wonderfully long "whisper" followed the Sabre's passage through the air—quite three times as long as that of the Beaufighter, which earned the name of "whispering death" by reason of the same phenomenon.

Westlands next took the stage with a formation flight by one S-51 (J. S. Fay) and two S-55s (Lt-Cdr. R. B. Bradley and S/L. D. A. F. Colvin). After take-off they ranged themselves in line, S-51 in the centre, in front of the crowd, showing their ability to turn smartly left or right, to go forwards, sideways or backwards in formation, to fly a very creditable imitation of Prince of Wales Feathers, and to finish up with dead-engine landings.

The local squadron of Sea Venoms (No. 890, Lt-Cdr. A. Gordon-Johnson) really needed a fine blue sky as a backcloth instead of the dismal grey then present. Their show was reminiscent of the Bulldogs at pre-war Hendon displays when aerobatics with coloured smoke were performed. To take the place of the smoke the Sea Venoms jettisoned the fuel from their wing-tip tanks—effective if a trifle paraffiny. As general information on the Sea Venom, the announcer gave the stalling speed as 130 m.p.h. and a range of 1,000 miles. They were, he declared, "only cleared for aerobatics yesterday." The show was very spectacular but suffered worst of all the events from weather—their final taxi-up the runway with wings folding was accomplished in a torrential downpour.

The item before the tea interval—Bill Bedford on a Hawker Hunter—was another Ministry of Supply "stop," so most of the crowd moved off for the next half hour to the protection of No. 4 Hangar for tea, while the tougher types stayed put or took a pleasure flight in a Cambrian Airways D.H.89.

A set-piece after tea was unashamedly given over to large bangs. Artillery, on the right, attacked a radar post on the left. It was evident that super-high-velocity shells were being used, because occasionally the missiles burst on the target shortly before the gun fired. Cdr. Cathode Ray was rather late in calling for air support and before the local squadron of Seafires (No. 1834, Lt-Cdr. C. Ford) could dive-bomb the offending guns his radar post had gone up in flames.

The last item on the programme was a display of parachuting by members of the Airborne Forces Depot, Aldershot, under the direction of Col. A. Pine-Coffin, D.S.O.

NEW POLAR SURVEY

A FURTHER familiarization flight over the polar route between Europe and the Far East was due to begin at 11 a.m. today with the departure from Tokyo of S.A.S. DC-6B *Leif Viking*. The aircraft took off from Oslo for Tokyo on Monday carrying 37 passengers for the Norwegian field hospital in Korea. During the return flight *Leif Viking* will call at Shemya and Adak (Aleutians), Cold Bay, Anchorage, Fairbanks and Barter Islands (Alaska), Bodö, northern Norway, and Oslo. It is due to return to Stockholm on Sunday afternoon.

It is not yet known when the Scandinavian airline will begin regular passenger services along the transpolar route. The only hold-up is the question of American traffic rights, which is at present being studied by the C.A.B. Although the State Department are reported to have approved the request for traffic rights at Los Angeles and San Francisco, the C.A.B. is said to be reluctant to allow S.A.S. to pick up passengers farther south than Seattle. A final decision is expected shortly.

HIGH TEMPO of Hunter production is emphasized in this recent photograph taken in one of the Hawker factories. The wing jigs (fuselage sections can be discerned in the background) are of the quickly transportable "raft" type used in all the company's assembly shops.

HERE AND THERE

Service Helicopters

IN the Commons last week Mr. George Ward, Under-Secretary for Air, told Mr. N. Dodds (Lab., Dartford) that some 20 helicopters—Dragonflies and Sycamores—were now in service with the R.A.F. Outstanding orders amounted to approximately 100, of which about half should be delivered within the next twelve months.

W.J.A.C. Recruiting Drive

THE Womens Junior Air Corps is staging a recruiting campaign, in connection with which their Fairchild Argus is visiting the airports of a number of provincial towns. Miss Freydis Leaf, W.J.A.C. chief flying instructor, is now assisted by a Polish ex-A.T.A. pilot, Mrs. Daab.

Bang on—Offshore

SALTFLEET, Lincs, bombing range—closed last December after, to quote the official description, "irregular releases" had landed in the town—is to reopen as soon as the necessary equipment for radar plotting has been installed. This, said the Under-Secretary for Air in a Parliamentary reply last week, would permit high-level bombing, three or four miles offshore, to be conducted without risk of further incidents.

Mountain Air Rescue

WHEN a party of skiers was overwhelmed by a recent avalanche on the Rosa Blanche in Switzerland, M. Hermann Geiger, airport manager at Sion, took off in a light aircraft, and landed on the mountain close to the scene of the accident. He flew out four injured people, and two dead, in successive flights. M. Geiger holds a record for the highest landing and take-off in a light aircraft in Europe.

Future of Tarrant Rushton

THE owners of Tarrant Rushton Airfield, near Blandford—the Crichel Estate and two local farmers—recently received notice of the Air Ministry's intention of applying for compulsory purchase of the land. It was stated that the airfield had to be retained in case of emergency, and that it was proposed to grant a further lease to the present tenants, Flight Refuelling, Ltd. The Air Minister has assured Mr. Robert Crouch, Conservative M.P. for Dorset North, that "no action has been taken which might be held to prejudice local interests."

Super-cinema

BELIEVED to be the finest private cinema in Southern England, the "Astradome" at Hamble reopened recently after being lavishly re-equipped. Its owners are Air Service Training, Ltd., whose students visit it to see technical and instructional films and—in off-duty hours—the best British feature pictures; since it first opened in 1948 it has given over 800 evening performances.

Three-day Model Meeting

BIGGEST event in the model-flying calendar, the National Model Aircraft Rally and the British Championships will be held at R.A.F. Station Waterbeach, near Cambridge, over the Whitsun holiday. Flying begins on the Saturday afternoon, and will continue from 11 a.m. to 7 p.m. on the Sunday and Monday. The meeting is under the auspices of the Society of Model Aeronautical Engineers.

Boosted

MAINTAINED by five aircraft manufacturers, the 900 m.p.h. wind tunnel at California Institute of Technology is to be rebuilt for speeds of over 1,400 m.p.h.

No Time Wasted

FOLLOWING the delivery of four Aiglets early last March to Kuwait, on the Persian Gulf, Austers have received a cable saying that "Cfahad El Atikid is first Kuwaiti in the world to fly solo." More first solos are imminent.

"He's been landing that way ever since he got back from Ford."

A Film Worth Keeping

A COPY of the Shell film *Powered Flight* has been presented to Sir John d'Albiac, commandant of London Airport, for preservation in the airport archives. It was handed over, at a recent ceremony, by Mr. C. M. Vignoles, Shell-Mex and B.P. managing director.

BRAZILIAN OFFICIALS recently visited Gloster Aircraft. Seen in front of Javelin No. 4 at Moreton Valence are, left to right: D. N. James of G.A.C.; Maj. O. F. Terra, Brazilian Air Force; Brig. Aboim, Brazil's D.G. of Civil Aviation; R. F. G. Carse, G.A.C.; Dr. A. M. Floret, Brazilian Air Ministry; and Maj. J. A. Studart, Assistant Air Attaché, Brazilian Embassy, London.

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By
W. M. ANDERSON

"FLIGHT" photograph

TURBULENCE IN CU-NIM

A Transport Pilot Recalls Experiences and Discusses Methods of Avoidance

THE subject of severe turbulence of the kind associated with the centres of thunderstorms has been the subject of various discussions and reports in the past. Some findings, based on R.A.F. test flights, have been published dealing with monsoon flying in India; others, from U.S. Air Force test-flight data, have dealt with thunderstorm flying in the Gulf of Mexico. Sutcliffe and other meteorological authorities have also had a little to say on the subject.

The findings have been somewhat contradictory, the American document, in particular, being of a kind that might encourage inexperienced pilots to fly rashly. Both lots of tests, especially the American, were done in military aircraft able to withstand much greater stresses than normal civil types.

A method recommended by the R.A.F. was to fly underneath the trouble, as low as possible in relation to the terrain or sea beneath. The report then listed black cu-nim (most dangerous), brown (dangerous) and white, which could be flown through—but preferably below 9,000ft, at the lowest safe speed, with autopilot out, while concentrating on lateral level, and riding the gusts to keep the speed safe, thus minimizing the chances of structural failure.

American recommendations seemed to be that there was no real danger except loss of control, and that the best height to fly was 5,000 to 6,000ft above the base, at normal cruising speed with autopilot in, making no attempt to chase the airspeed or turn.

Pilots who have been in a really super cu-nim, and lived to tell the tale, may well feel that the Americans must have missed the really big ones, otherwise they would not advocate such a press-on-regardless policy. It may be appropriate here to list a few incidents, including some I myself have experienced, making no attempt at a sequence or history.

Pilots who flew through storms in India and the Bay of Bengal to collect data for the R.A.F. cu-nim report are said to have been so badly shaken that they nearly decided to end their days in a monastery; however, this may be an exaggeration. The personal reactions of the American pilots are not recorded.

During the war in the Far East, at least 19 aircraft—mostly Dakotas, which probably flew in worse weather than the majority of operational aircraft—broke up in cu-nim; and the number of unexplained losses was probably higher.

Although I had done a considerable amount of cloud flying, my own first experience of cu-nim was at night, North of Sicily in a Boston during October 1943. We had a target in Italy—the road bridges at Capua—and were flying from the Gerbini area near Catania. Shortly after crossing the North Coast of Sicily we entered the storm at 10,000ft. After about 15 minutes—during which time all I could manage was to keep the aircraft right side up, and within 90 deg of course—and with the rest of the crew violently sick, I decided to turn back. (This was my 79th bombing trip, and only once before, owing to flak damage over France, had I been forced to turn back.) It took five minutes to turn around to a general southerly direction, and a lot longer to get back to base without hitting Mount Etna, as the only radio station on the North Coast of Sicily had been struck by lightning.

Eventually, searchlights through the clouds gave us the position of the Straits of Messina. Later we learned that two out of five aircraft operating that night were lost through weather; a less robust type than the Boston would certainly have broken up under the stress which we ourselves encountered.

In Ceylon I was told about a Sunderland which broke up in a storm off Trincomalee. Later, during 1946, I met a pilot, of about 45 years of age, who was flying Lancastrians for Qantas from Australia to Ceylon. Over a drink in the mess at Negombo he said they flew through the Inter-Tropical Front at night (the worst time over the sea) and at 10,000ft, finding it very uncomfortable but quite safe. I explained how, in Transport Command, we had found that by flying at 200ft by radio altimeter we could avoid most of the turbulence; we then had only very heavy rain to contend with, as the descending currents were slowing down and the ascending ones had not speeded up. But he disapproved of such methods. About three weeks later I met him again. Now he was talking of retiring to a ranch; his best friend had just disappeared in a Lancastrian at night. The last position report had put the aircraft just entering the I.T.F. at 10,000ft. (And, one remembered, the amount of punishment a Lancaster could stand had many times been proved.)

During September 1945 I was flying a York from Rabat Sale to England at night. According to the weather man a large depression in the Bay of Biscay had occluded and was dying out; for about 200 miles we could find layers of stratus, but no cumulus. All went as forecast—layers of stratus, stars visible through gaps—but by climbing as the layers thickened we still kept between thin layers.

Suddenly, without warning, at 14,000ft we ran into a grand-daddy cu-nim. The pitot heater was on, and de-icers on normal. The aircraft was struck by lightning, and one

TURBULENCE IN CU-NIM . . .

radio set blew up. Later, we found that severe hail had torn the de-icer boots off the wings and tail surfaces.

Meanwhile, with two of us fighting the controls—feet on the instrument panel at times—and with engines on full power we lost height to 4,000ft, the altimeter unwinding madly. During this performance the pitot iced up, and someone was heard to say on the intercom: "If I ever get out of this I'm buying a chicken farm."

Then, without time to breathe, we went up—throttles fully closed, altimeter winding up, rate-of-climb stuck at 4,000ft/min—until we were thrown out of the top (or perhaps the side) of the cu-nim at 19,500ft.

The navigator estimated, with the aid of the Aldis lamp, that we had three to four inches of ice on the wings; we could only just maintain height on full power, at a very uncomfortable angle, without the A.S.I., and unable to see owing to ice on the windscreen. Eventually, with A.S.I. unserviceable and both compasses about 30 deg wrong, owing to the alteration in magnetism, we made St. Mawgan by homing on the radio range, two hours overdue. This again was a strong aircraft, but it had suffered sheared rivets; we had 17 passengers plus a Merlin engine on board.

On December 23rd, 1945, another York crew had a similar experience over the centre of France, and their middle tail-fin was torn away. It was following, at about 30 minutes' interval, a Transport Command Liberator with 32 troops, flying at 14,000ft; and that aircraft broke up about 20 miles North of Marseilles. Following both these aircraft, I attempted to get above cloud. The tops were forecast at 16,000ft, but at 23,000ft (and – 40 deg C) we ran into heavy turbulence. Mindful of previous experience, I turned back. During less than the two minutes which we took to get out of the cu-nim, we picked up over two inches of hard glazed ice; and at that time glazed ice was supposed to form only in temperatures above – 18 deg C.

Near this same area, in more recent years, a Viking landed at Nice with the captain unconscious and most of the passengers injured.

One of the Tudors lost over the Atlantic is presumed to have hit the sea while flying at 2,000ft indicated, owing to an exceptional change in barometric pressure while flying under a storm in heavy rain. Could the other one have been a victim of similar circumstances? Or did one or both break up in cu-nim?

In the case of the C.A.A. Viking which broke up near Pangani in Tanganyika, only the fatigue aspect seems to have been stressed, whereas the Valetta centre main spar, fitted only 12 months before, also broke, showing no fatigue. One A.R.B. surveyor stated that the aircraft appeared to have become inverted in a cu-nim and to have broken up because of stresses beyond those that could be withstood, the fatigue in the outer wing-root fitting being possibly a contributory factor.

About the same time as these last two accidents, two civil aircraft broke up in storms in America.

We are informed by meteorological experts that hailstones of 4½in diameter have fallen in Northern Rhodesia. The calculated vertical currents required to sustain a hailstone of this size during its formation is, apparently, one of about 200 m.p.h. If I remember correctly, he said that an aircraft cruising at 100 m.p.h. and meeting such a current would be subjected to 5 or 6 g; or, cruising at 200 m.p.h., about 19 g—the g increasing as the square of the speed. Whether this is exactly correct or not it is a serious thought when one bears in mind the increased operating speeds of today.

During 1946 the R.A.F. sent to Singapore a Lancaster fitted with a modified H_2S in the nose, to experiment with cu-nim flying. We were told that it was very successful and that the centres of high electrical potential associated with strong turbulence could all be avoided, but that the weight of the equipment was much too great for civil aircraft. About five years later we learned of the commercial development of a cloud-and-collision warning radar weighing about 70 lb and to cost about £4,000. It was claimed that it would detect aircraft and thunderstorms at 60 miles range and could be deflected 45 deg downwards to locate ground objects.

What has happened to this radar? Is it as good as originally stated, or not? If it is good, why have airlines not spent a mere £4,000 per aircraft worth a quarter to a half million pounds? Surely, with airlines flying in all weathers, and at increasing speeds, it is imperative that effective cloud-and-collision radar should be a compulsory safety-aid—apart from the consideration that avoiding turbulence makes things more comfortable for passengers, and should also lessen the risk of fatigue in aircraft components.

Perhaps operators expect to fly at 45,000ft above the weather, hoping by good luck to miss cu-nim on climb and descent. However, I have seen cu-nim up to 65,000ft, and Comet crews have reported tops at 55,000ft in central Africa, sometimes hidden in stratus which they cannot get above at 45,000ft. Over desert areas, and in the Persian Gulf, there are day thunderstorms having all the usual characteristics but—owing to lack of moisture—without cloud. A four-engined aircraft had its wings bent down 18 inches in one of these storms south-east of Benghazi; the centre-section was also strained.

Can somebody tell us more about cloud-and-collision warning radar? Can it be perfected so as to give mountain outlines, and to eliminate rain clutter? Could it, in conjunction with infra-red lights (as has been suggested) be used for seeing the runway or flarepath during finals on an instrument landing? If that were possible, then Fido could be dispensed with except in dire emergency.

[The equipment referred to by Capt. Anderson is, clearly, that made by E. K. Cole, Ltd., and known as the Ekco airborne search radar. We hope to give, next week, the manufacturers' answers to our contributor's questions.—Ed.]

RUSSIAN ROCKETRY

A FEATURE of the recent space-travel symposium held recently in New York—at which Mr. Arthur Clarke, of the British Interplanetary Society acted as co-ordinator—was an appraisal of Russia's rocket programme. Mr. George Sutton, supervisor of the aerophysics department of North American Aviation, asserted the U.S.S.R. was at present working on a liquid-propellant motor with almost five times the thrust used in the German V.2. Pointing out that Russia was able to make an early start in rocket work, and that all except one major German rocket-development centre fell into the Soviet Zone, he said that the U.S.S.R. possessed all four of the requirements necessary for the development of advanced rocket engines—able technical men; large research facilities; factories capable of producing the engines, and good test facilities. "Rockets are an essential part of any space-ship development," said Mr. Sutton, "and the Russians appear to have the necessary background to attempt confidently the perfecting of rockets for space-flight."

The German war-time programme at Peenemünde was described for the meeting by Dr. Walter Dornberger, a former major-general in the German Army, who was military head of the project. He is now missile consultant at Bell Aircraft Corporation.

Dr. Fred Singer, physics professor at the University of Maryland, described his Mouse ("Minimum Orbital Unmanned Satellite") project for an unmanned vehicle, weighing only 100 lb, to operate on an orbit about 200 miles from the Earth and passing over the Poles. A three-step combination it should be possible to launch Mouse at the present time, and its signals could be received by aircraft operating in the Polar regions each time it passed over one of the Poles, or about every 45 minutes.

J. F. BYRNE

WE learn with regret of the death, in his 83rd year, of Mr. J. F. Byrne, chairman of Smith's Stamping Works (Coventry), Ltd. He had been on the Board since 1920; at the amalgamation of that company with Smith Clayton Forge, Ltd., he joined the latter's Board also, and in 1944 he became chairman of the whole group. In his earlier days he was a sportsman of exceptional prowess; he had played as full back for England in many international rugby football matches and, as a cricketer, had captained Warwickshire from 1903 to 1907; on one occasion, in a Gentlemen v. Players match, he bowled the great W. G. Grace twice in the same game.

Part of the wave formation discussed below. The wave is seen in the undulating shape of the inversion haze-top, in front of which is the rising cumulus formed by thermals from the lee slope.

ISLE OF MAN LEE-WAVE

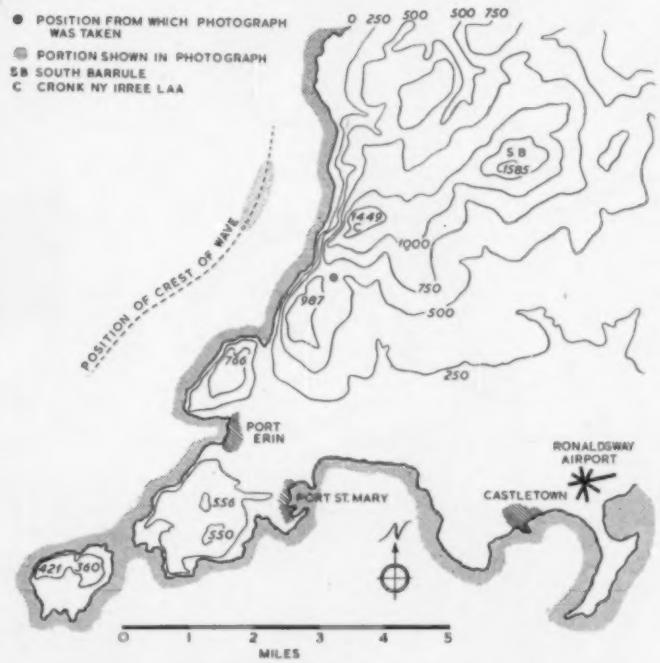
An Unusual Cloud Formation Seen During the I.C. Meteorological Expedition

AS reported in our issue of May 14th, a meteorological and gliding expedition recently visited the Isle of Man, in order to study atmospheric waves formed in the lee of mountains. The photograph above, showing part of one most unusual wave formation observed there, is described in the specially written account below by Dr. R. S. Scorer, of Imperial College Meteorological Department, who led the expedition.

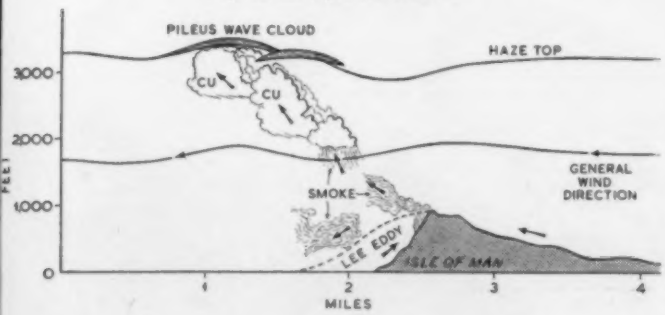
During the afternoon of April 25th, 1954, observations of smoke and cloud movements were made off the west coast of the Isle of Man in a moderate east wind. At about 1900 hr G.M.T. an unusual wave-cloud was seen about a mile out to sea, and part of this is shown in the photograph. Before and after the cloud's formation the wave was visible in the haze top; and the cloud seemed to form during the time that convection from the lee slope of the mountains was most active. This convection was made visible by many heath fires.

The wave was most active to the lee of where the mountains descend most steeply to the sea, and the sea-level wind was blowing up these lee slopes. Thus there was a lee eddy, which for the purposes of the air flow higher up transformed the shape of the mountain approximately to that shown dotted in the figure. But this eddy was not constant in size and shape, and from time to time a thermal could be seen (by the smoke it contained) to break out of the eddy, rise, and soon form a cumulus cloud. The lapse-rate in the air up to the haze-top was dry adiabatic, and there was, in general, not enough moisture to form cumulus. The moisture added in the combustion of the heather, however, produced condensation at about 2,000ft, and from there onwards the ascent of the cumulus was very rapid, because the air was highly unstable for the ascent of cloudy air.

The strongest thermals were probably composed largely of air that had remained in the lee eddy for the longest time, and had been warmed by the fires and by contact with the



(Below) Diagrammatic cross-section, illustrating the formation of cumulus and pileus ("cap") cloud. (Right) The area investigated, showing the west coast with its steep lee-slope and the parallel line of the wave crest. Ronaldsway was the expedition's base.



ISLE OF MAN LEE-WAVE . . .

sun-facing westward slopes. These thermals ascended through the average stream-pattern, of which one stream-line is inserted (by guesswork) in the diagram.

If there had been more moisture in the airstream the wave would probably have been revealed by a smooth wave-cloud, as indeed it was on a previous evening. The wave cloud on this occasion was most pronounced when a thermal ascended in the wave and produced a "pileus" (cap) over the cumulus.

Most important from the aviator's point of view, however, is not the thermal activity but the wave itself. The vertical currents were greatest to the lee of the mountains. On more than one occasion the South Barrule (see map) produced no detectable displacement of the haze top while the Cronk-ny-Irree Laa caused a visible wave out to sea. This is almost certainly because the Cronk-ny-Irree Laa has a steep lee-slope in an east wind and forms part of a long piece of precipitous coastline more nearly two-dimensional than the South Barrule, which is of smooth rounded outline and is somewhat isolated.

On this occasion we saw pieces of wrecked aircraft on the Cronk-ny-Irree Laa; it is obviously a mountain that should be treated with respect by aviators.

ARMY-R.A.F. TEAMWORK

An Army Visitor's Impressions of the Work of 1900 Independent A.O.P. Flight, Hong Kong

THE commanding officer of an infantry unit in Hong Kong surveys a grass-covered platoon and would like to make sure that his regiment is well camouflaged against enemy aircraft; one of H.M. destroyers would like her radar aligned; and another infantry unit would like a few supplies dropped to them. In many such cases, the officers concerned would turn to the 1900 Independent A.O.P. Flight for help; and, if available, one of the Flight's five Austers would leave its base at Shatin, Hong Kong, to carry out yet another liaison duty with Armed Forces stationed in the Colony.

These are but a few of the many duties carried out by 1900 Flight, one of the smallest units in the New Territories—a unit which is always pointed out to Important Visitors as a climax to any tour of inspection of Artillery units.

Although the Flight is primarily a Royal Air Force unit, it co-operates with every branch of the Services, although its main duty in war-time is to fly out over enemy lines and radio back positions of targets hidden from ground O.P.s. The pilots are all Royal Artillery officers of the rank of captain or above, for a spotter needs a thorough knowledge of gunnery.

The headquarters building of 1900 Flight stands on the shore line of Tide Cove, half a mile away from Shatin's small Chinese shopping centre. At first sight it could easily be a mansion built by someone with a comfortable bank-balance, for the three-storeyed house, with its small bell-tower, has been recently snow-cemented and stands, splendidly isolated, against a rough background of hills and water.

The Flight's staff is a combination of Army and R.A.F. The ground-crews, the cooks, medical orderly and one clerk are airmen, while the Army provides an R.A. sergeant-major, drivers, signallers and a clerk. The men have been divided up into teams, one for each Auster. Each section has a jeep, with a driver-operator, a truck for carrying spare parts, and two airmen who carry out maintenance duties on the aircraft.

The Flight arrived at Hong Kong in April last year, its aircraft in packing cases and all under the care of Maj. J. B. Chanter, M.B.E., R.A. Maj. Chanter left in November and relinquished his command to Maj. A. D. Andrews, M.C., R.A., who flew spotter aircraft with 651 A.O.P. Squadron in 1946, hunting terrorists and illegal immigration ships in Palestine.

The men stationed with the Flight take great pride in pointing out that one of their spare-time hobbies is flying, for any time one of the pilots makes a trip and there is a spare seat in one Auster, he is usually willing to take one of the ground staff along with him. For those who can handle a boat, there is the 14ft dinghy, recently purchased out of the Flight funds, which the men sail regularly in their spare time.

The ground floor of the headquarters building has a dark-room, equipped with cameras, developers and enlargers, and the Flight is thus virtually independent when given photography missions to carry out. Cpl. Jones, R.A.F., is in charge and he does most of the camera work, leaning out of the cabin doors of the Auster—the only way to get really clear pictures.

To the uninitiated, a flight in one of these aircraft is something of an experience. The ground-crew, wheeling the Auster out on to the Strip (it is never referred to as a runway by experts) covertly eye a novice's fumbling attempts to tie on the yellow life-jacket and occasionally volunteer advice on procedure should the aircraft ditch in the sea: "Pull this and it inflates. If that doesn't work, blow this. There used to be a whistle there, but someone seems to have pinched it." One somehow begins to feel lost without a whistle.

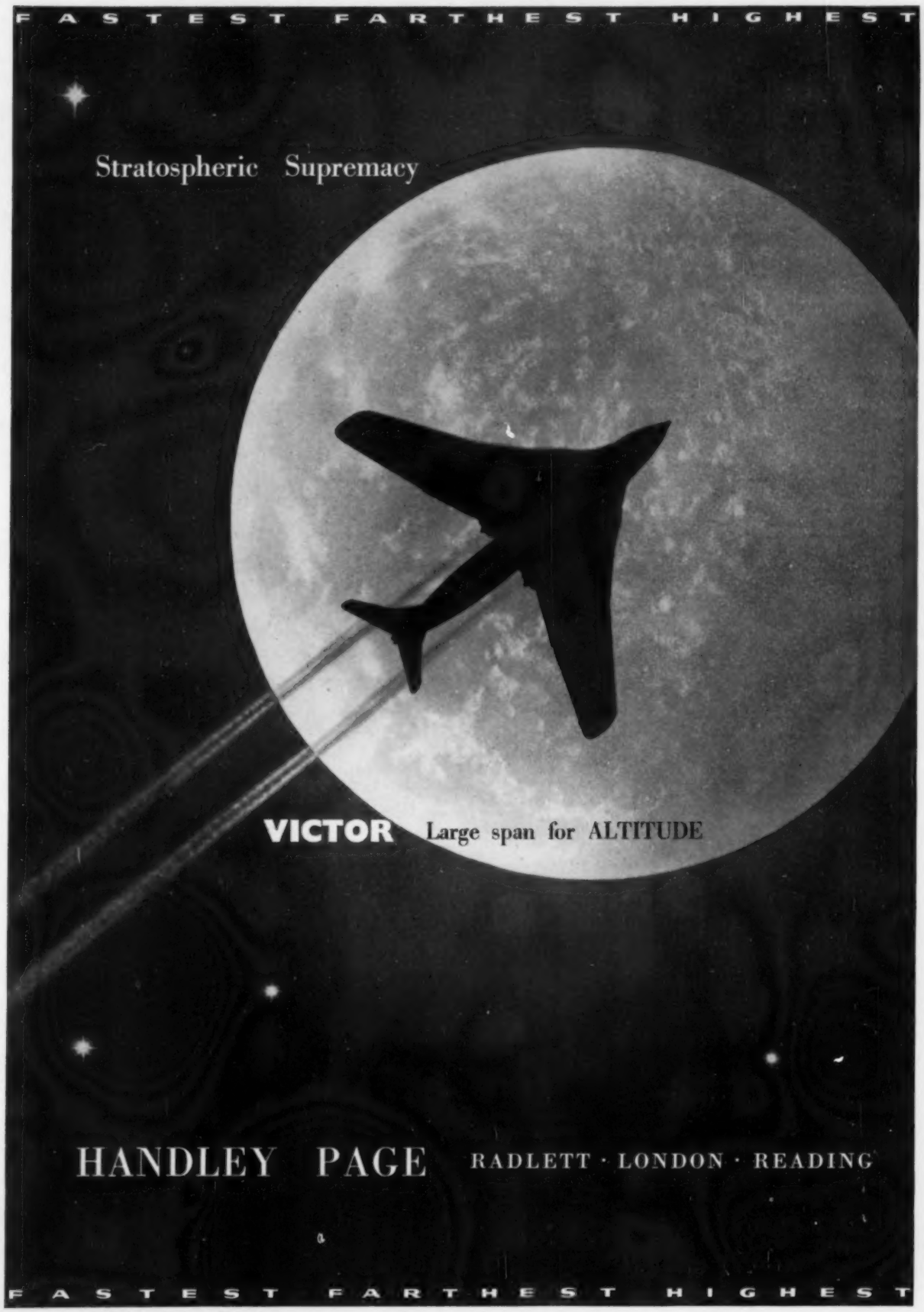
From above, the New Territories take on an entirely new appearance: enormous slopes, roll upon roll of them, dotted with scrub and veined with tiny paths and inland waterways faintly ruffled by a strong breeze. Sailing over the hills, the passenger can strain against his safety-belt and watch the panorama below, or lean back listening to the noise and watching the thin wraiths of cloud whipping back over the wide cabin roof.

Over Hong Kong, the shipping centre of the world looks remarkably orderly, with a few merchant ships moving aimlessly around, trailing small white wakes behind them.

Perhaps the main advantage an Auster holds over larger modern aircraft is its amazing manœuvrability, which the pilots are allowed to demonstrate over the waterways of Tide Cove. Its ability to turn almost on a ten-cent piece would be very handy for a pilot who had to take evasive action against high-speed aircraft. He puts his Auster into an uncomfortably steep side-slip, pulling out just above ground level, giving the passenger a brief impression of mountains whirling above his head. When a spotter wants to show the position of a hidden enemy position without using wireless he does so by making his aircraft leap up

Pilots of 1900 Independent A.O.P. Flight, stationed at Shatin, Hong Kong, are experts at getting their Austers into and out of short strips, sometimes in areas surrounded by tall trees or high ground.

THIS article, written from a non-R.A.F. viewpoint—Military Observer P. C. Dunn is the author—throws some interesting sidelights on the activities of a basically R.A.F. unit whose personnel are drawn from both the Army and the R.A.F., and whose varied duties extend on occasions to giving a helping hand to the Royal Navy. A brief account of the war history of the unit and of its predecessors is also given.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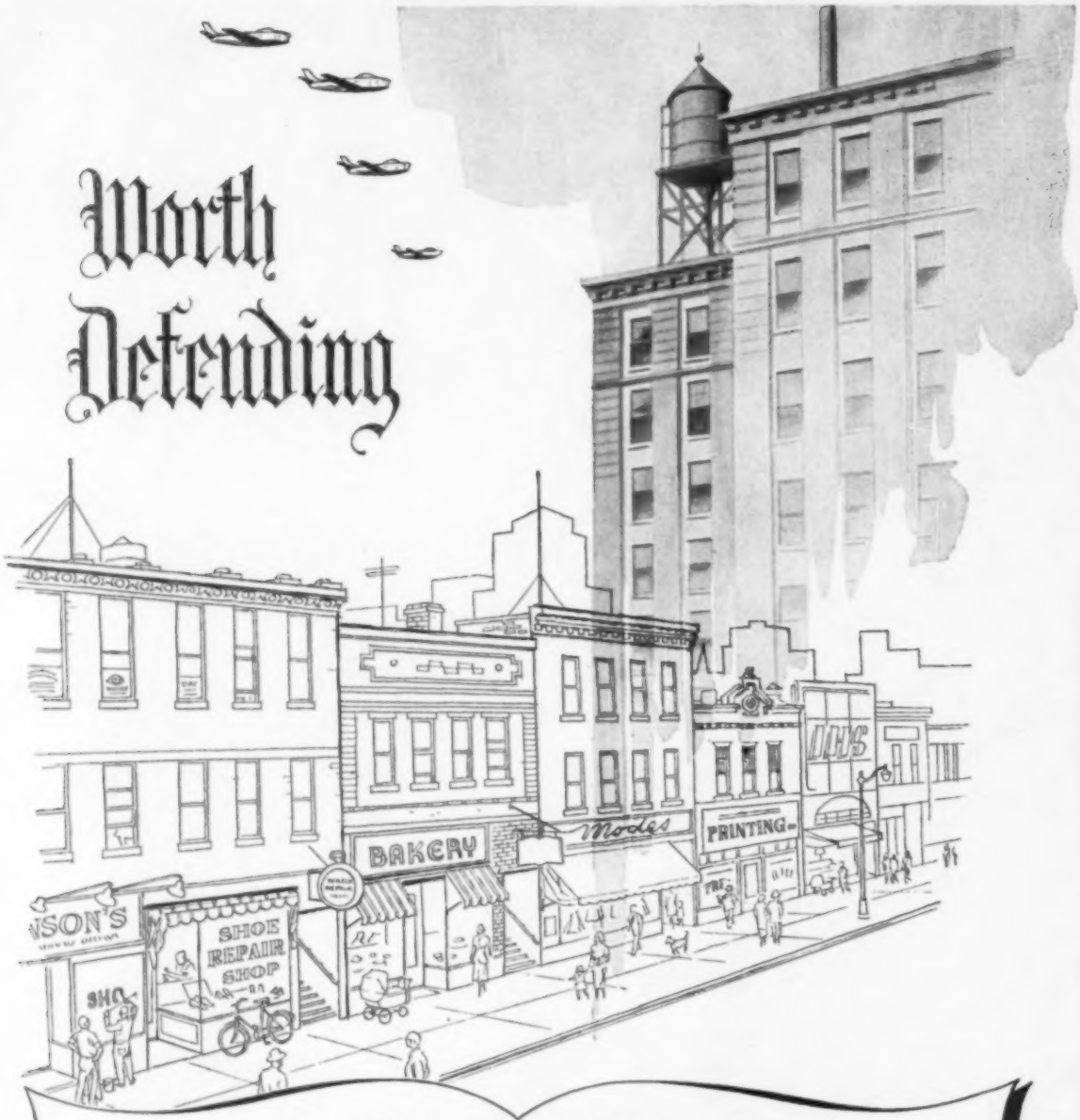

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The fitter in the picture above, working on one of the A.O.P. Austers, has as an incentive the prospect of accompanying the pilot on a flight. The group picture shows the pilots of 1900 Independent A.O.P. Flight—(left to right) a visitor, Capt. J. H. Pike, R.A., Capt. P. J. Furse, R.A., Maj. A. D. Andrews, M.C., R.A., Capt. H. G. Horner, R.A., and Capt. T. J. Reynolds, R.A. In the lower view, three R.A.F. ground-crew (L.A/C. D. E. Smith, S.A/C. T. Slim and L.A/C. D. Gobbett) are seen refuelling one of the Austers. Here there are no high-speed pressure refuellers.

ARMY-R.A.F. TEAMWORK . . .

and down over the covering ground, usually a low hill, reminding the passenger of a playful dog.

The ground-crew are apt to tell the guest-passenger how pale he looks when he lands. Pinned to the wall of the Flight office is a small chart headed "Shooting the Cat"—a polite way of putting "List of People who were Airsick." Any new addition would certainly be in good company, including that of a certain subaltern who said, loudly, that no one could make *him* airsick. His name duly appeared on the list with "windy" against it.

The Flight have recently started to build a hangar for its aircraft, which at the time of the writer's visit were parked in a barbed-wire compound. At night, the compound was patrolled by Army guard-dogs, an effective way of keeping the area clear of nocturnal marauders.

No. 1900 Independent A.O.P. Flight has a history which is treasured just as much as those of any of the larger formations. The Flight was formed as "A" and "B" Flights of 657 Air O.P. Squadron at Woolsington, Newcastle, in January 1943. The two Flights, equipped with the new Auster Mk 3, left for Algiers after six months' training. Once in North Africa, they carried out further training until ordered to join the 8th Army in Italy. The ground-crews and stores were taken by sea to Naples and the pilots flew the aircraft across the Mediterranean from Tunis to Vasto.

As soon as reorganization was completed, the two Flights were placed under the command of the 1st Canadian Corps and took part in all major campaigns of that period, including the assaults on Cassino, the Hitler Line and the Gothic Line.

In March 1945 the Flights were withdrawn from Italy and transferred to Marseilles. They then travelled by road through to Belgium, where they once again came under the command of the 1st Canadian Corps, fighting in Holland at the time. They remained with the Corps until hostilities ceased in the same year.

During the war, 657 A.O.P. Squadron carried out 4,444 shoots and earned a total of one M.B.E., nine D.F.C.s and eight Mentions in Despatches.

In November 1945 the Flights returned to the United Kingdom with their Squadron and were placed under the operational control of the School of Artillery, for training and communication duties. Until the Squadron moved to Andover early in 1946, they were based at R.A.F. Station, Rolleston, near Larkhill.

December 1946 saw the birth of 1900 A.O.P. Flight, a title given to the amalgamated "A" and "B" Flights. Still with its mother squadron the Flight moved to Middle Wallop in 1948 and, two years later, became affiliated to the 3rd Infantry Division.

In the following year 1900 was posted to the Middle East and carried out its normal duties until ordered to proceed to Hong Kong in March last year. Before the tip of Land's End disappeared over the horizon, the Flight was basking under the new title of 1900 Independent Air O.P. Flight. It is now under the command of 40 Infantry Division, New Territories, Hong Kong.

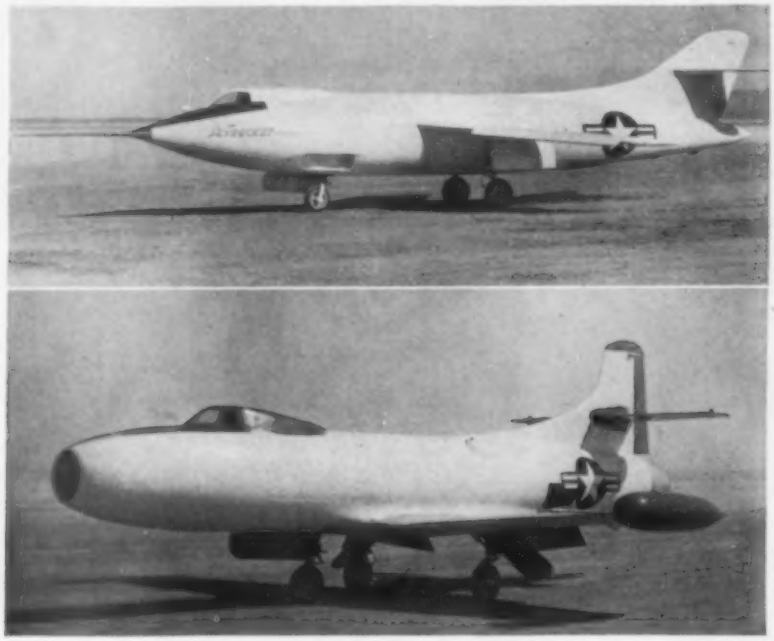
HELICOPTERS: TOO MUCH CAUTION?

UNABLE to be present at the recent ninth annual general meeting of the Helicopter Association by reason of an overseas visit, Mr. Eric Mensforth, C.B.E., sent to the meeting his presidential address (he had consented to continue in this office for 1954-55). In it he said that, though the Association had undoubtedly made material contributions to the increased awareness of and interest in the helicopter by the general public, there was no room in Britain for complacency. Here was a wonderful challenge to create for our country both a new export industry and a means of speeding up our internal communications system. Could we go on waiting for twin-engined machines to prove routes and develop ancillary services when Sabena were already showing, with the utmost courage and skill, what could be done with single-engined helicopters? We could not afford to be too cautious or to want to see every regulation worked out in advance.

In a review of the past year's activities, Mr. Norman Hill (chairman, executive council) said that membership had increased, and that the Association's financial position had been improved both by the additional subscriptions and by generous donations from both individuals and firms. An accommodation fund had been opened in order that the Association might ultimately have its own premises; meanwhile, a generous offer from John Brown and Co., Ltd., had enabled them to move their office H.Q. to 4, The Sanctuary, Westminster.

A ballot to fill the six vacancies on the council resulted in the re-election of Messrs. J. W. Richardson, C. C. Cooper and L. G. Frise, and the election of F. O'Hara, B. H. Arkell and F. T. Meacock. After completion of the official business there was a film show, the programme including *Air Head*—about the use of helicopters by the U.S. Marine Corps in Korea—and a film of the first flights of the W.S. 55, on which Mr. O. L. L. Fitzwilliams (Westland's chief helicopter designer) gave a commentary.

AIRCRAFT INTELLIGENCE



SPEEDSHIPS: A far cry from the airliners and carrier-strike aircraft made by the same company, these Douglas Skyrocket (top) and Skystreak aircraft are still flying on aerodynamic research. Recent modifications include cropping the fin of the former aircraft, which is depicted in pure-jet form, with rockets removed. Three of each of these aircraft were built.

Great Britain

Avro Shackleton. Last week we published a maker's photographic-cum-artist's impression of the new Shackleton MR.3, with tricycle undercarriage and other improvements. In this illustration it appeared that the main units of the landing gear were retracting backwards; this is, in fact, not the case. Each main leg retracts forwards, and the backward-sloping struts visible in the impression are radius rods and drag struts. The-twin wheel undercarriage units comprise Electro-Hydraulics main gear and a steerable nose unit by Dowty.

U.S.A.

Boeing B-47. It can now be revealed that Boeing B-47Es in U.S.A.F. service are equipped with an automatic radar-controlled tail turret, equipped with twin 20 mm guns which should be able to knock down enemy fighters in any conditions of darkness or bad weather. Developed by American G.E.C., and made by that company and by the Crosley division of Avco, the new turret has a magnesium-alloy structure, and houses search and track radar, control equipment, a computer and the guns and ammunition. All the crew need do is to switch on the search radar when entering enemy territory; once a target has been found, it is tracked automatically, and the guns fire at a predetermined range.

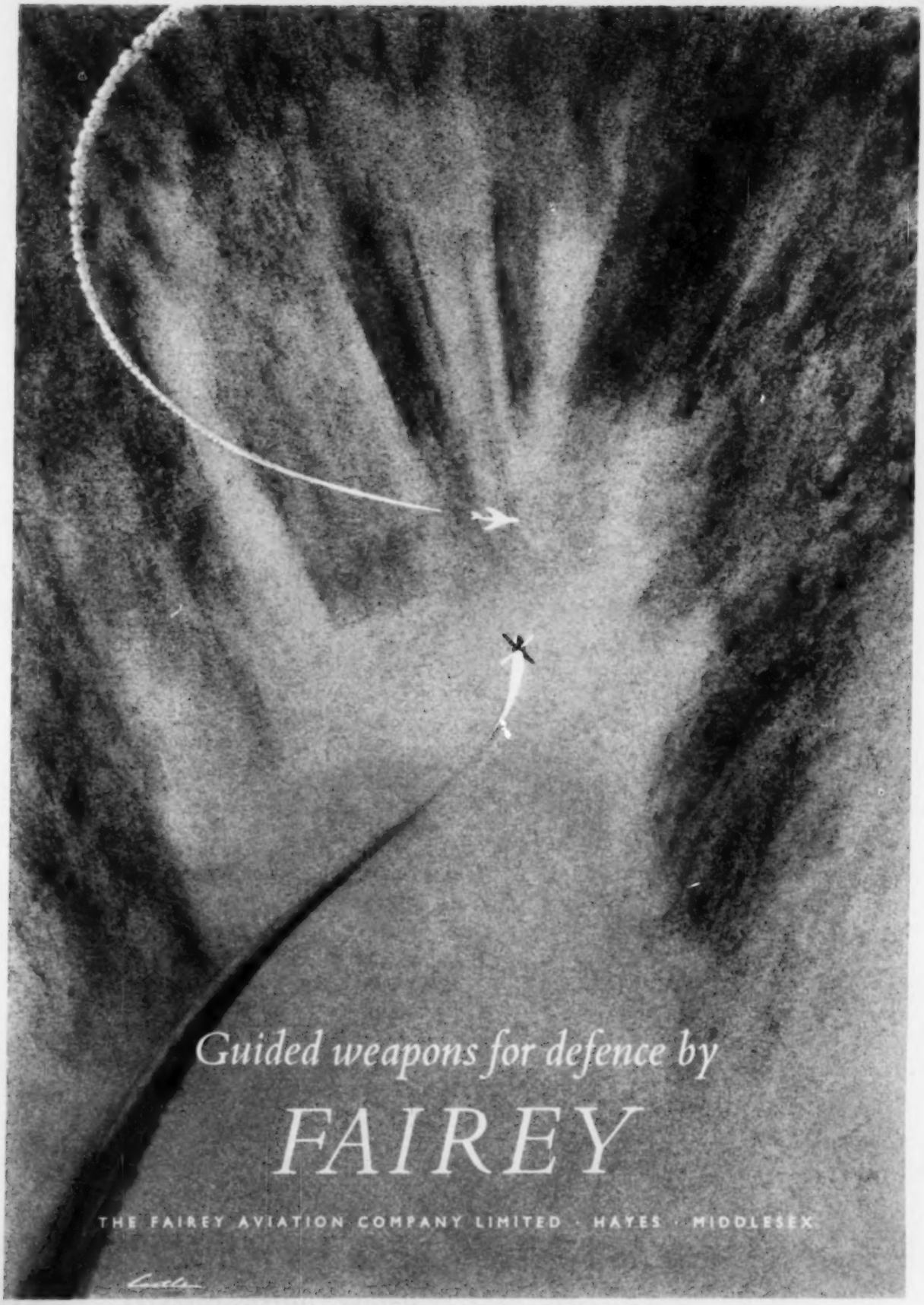
Chance Vought Regulus. One notable feature of this pilotless target, in mass production for the U.S.A.F. and U.S. Navy, is the method of pumping fuel from the main tanks. A flexible diaphragm is fitted completely across the interior of the tank and all the fuel lies on one side of the diaphragm, the latter then being held against one wall of the tank. When the engine of the Regulus (a J44 or J69 turbojet) is started, the diaphragm is pressurized on the side opposite to the fuel by a pressure-bleed from the turbojet compressor. This gradually forces the fuel through the delivery line to the engine fuel pump. This system is very light and simple, and has previously been employed in some rocket vehicles and missiles.

Northrop Scorpion. Subject of the three-view drawing below, the F-89D is the latest service version of a large two-seat all-weather fighter now in wide service with the U.S.A.F. Air Defense Command. With two afterburning J35 turbojets, it has the remarkable armament of 104 Mighty Mouse air-to-air unguided rockets, which are housed in the forward sections of the wing-tip fuel tanks. The nose is left free of ordnance, so that the bulky Hughes automatic radar fire-control equipment can be accommodated. Earlier Scorpions mounted six 20 mm guns in the nose.

Sikorsky S-59. Already briefly described in this journal, the S-59 is a development of the little S-52 helicopter, but has a Continental Turboméca Artouste shaft-drive turbine for power. Scheduled to fly soon, the S-59 has a number of entirely new features, including a new form of fuselage (almost certainly with a fixed fin and "aircraft-type" rear fuselage, as distinct from the original pod shape) and a fully retractable nosewheel-type undercarriage.

NORTHROP F-89D SCORPION
(Two Allison J35-A-35)

Span	56ft 2in
Length	53ft 4½in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FAIREY
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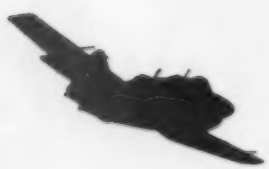
Roy Nockolds' design to illustrate "Endurance", upon which depends the effective striking power of fleets at sea, the forewarning of attack . . . the safety of aircrews and their aircraft. Endurance is a factor which aircraft designers have long sought to reconcile with high performance; the Double Mamba turboprop has been designed to meet this requirement.

THE DOUBLE MAMBA Basically two Mamba engines side by side driving independent co-axial four-bladed airscrews, the Double Mamba develops 2,950 e.s.h.p. Each unit is entirely separate; neither can be affected by loss of power or injury to the other. Specially designed for deck-landing aircraft, ★ the Double Mamba has the power potential, handling qualities and safety factors of a twin-engined aircraft, combined with the fuel economy and stowing facilities of a single installation.



★ *The Fairey Gannet — super-priority for the Royal Navy — is powered by the Double Mamba.*

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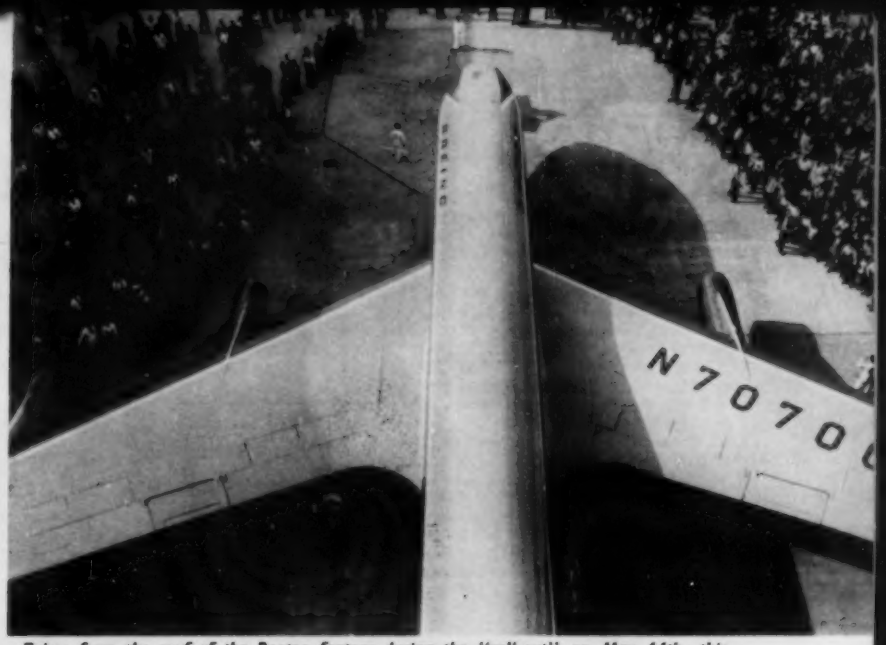
Stratotanker

Boeing's New Prototype, Called Stratoliner in Civil Form



Taken from the roof of the Renton factory during the "roll-out" on May 14th, this photograph shows the movable wing-surfaces discussed in the text. The flaps are discontinued behind the inner engines, the space being occupied by the small flipper ailerons; the four spoilers are also clearly visible. The large trailing-edge fillets are necessitated by the housing for the retracted bogies.

THE Boeing Airplane Co. of Seattle is one of the largest aircraft firms in the world. They occupy plants at Seattle and Renton (Washington State) and at Wichita (Kansas) with an aggregate employment of at least 80,000. Such a company has a potential to be reckoned with under any circumstances and its achievements since 1945 have, in fact, been immense, if largely of a military nature.

During the late 1940s Boeing saw clearly that a jet transport was going to be needed, both for military and civil applications. There was at this time a considerable body of opinion in America which felt that we in Britain had been able to develop a jet transport solely by the expenditure of Government money and that the operation of such aircraft was possible only when the airline was underwritten by the taxpayer. The argument generally concluded that the American industry had to be cautious, owing to its dependence on stockholders, and that jet transports were, as a consequence, not for the immediate future.

Boeing did not fully subscribe to this view. On the other hand, they were very careful to ensure that, when they produced their new transport, it would have the optimum layout. Transport design is, as we outlined last week, a tricky business, in which there is no room at all for anything less than the best. Boeing are old hands at the airline game, for their Model 247D was the first modern monoplane airliner and the Stratocruiser needs no introduction. Nevertheless, the company were shrewd enough to aim at producing an aircraft, the basic design of which would be suitable for the widest possible range of rôles.

Most of the engineering information acquired by Boeing stemmed from the B-47 and B-52 bombers, the KC-97 tanker and the civil Stratocruiser, but much additional information was obtained from over 150 "paper" projects which never flew—turbojet and turboprop aircraft of all shapes and sizes. Some of these projects were no more than rudimentary layouts and weight statements, but a score of others were carried far along the process of design and stressing, including extensive tunnel testing and exhaustive mathematical analysis, the final results being worked into brochures for consideration by military and civil customers.

The work really began in 1946 when the design staff were largely occupied with the B-47. The commercial jet project was known as the Boeing 473 and the first proposal was quite a small aircraft powered by two Rolls-Royce Nenes. At the end of 1948 the design department had reached the twenty-fifth project which was a 264,000 lb aircraft powered by six of the new Pratt and Whitney J57 turbojets. Other variants were conceived as turboprop aircraft for feederline use. But by mid 1949 it was apparent that neither Boeing nor the potential operators had sufficient knowledge of jet transports to justify detailed design. Accordingly a comprehensive study of jet transport operation was undertaken based on the performance of a hypothetical aircraft. This, said Boeing, constituted by far the most thoroughly filled package of jet transport information assessed by anyone at that time.

The study evoked favourable reaction and prompted further design along somewhat different channels. A significant point was reached in 1950 with the Model 473-60, a design which was projected in two 60-passenger versions, a 135,000 lb domestic model and a transocean aircraft shown in weights up to 180,000 lb. But extensive tunnel testing and engineering study gave rise to doubts which centred largely about the undercarriage—a narrow-track tricycle arrangement with all three units housed in the fuselage. So much for the early airline projects.

While progressing with the 473-60 Boeing was also searching for the best form for a new tanker-transport for the U.S. Air Force. By 1950 it was already apparent that the KC-97 Stratofreighter, capable as it is, could do no more than a marginal refuelling job for the U.S.A.F. bomber wings then being formed. What was wanted was an aircraft which could refuel the B-47 at the latter's own height and speed. It appeared that it might be possible to retain the "97's" capacious fuselage, restricting alterations to the wing and power plant group. On this basis, therefore, a spate of Model 367 tanker/transport designs began to materialize.

One of the earliest merely replaced the Stratofreighter's piston engines with four J35 turbojets. By 1950 the Model 367-31 was developed with four Wasp Major piston engines and two J34 turbojets; another of that year was the gull-winged Model 367-60 with four T34 turboprops. But there was a growing feeling that, as American combat air power was steadily becoming all-jet, the optimum tanker would likewise be an all-jet aircraft, with appropriate speed and altitude capabilities. Late in 1950 the 367-64 appeared; this was a C-97 with an entirely new thin wing, two twin jet pods and a new side-folding bogie undercarriage developed for previous new-wing revisions of the C-97. Drawings of the 367-60 and 367-64 were published in our issue of April 16th last.

Boeing engineers entered 1951 hard at work upon the 367-64, and the company has pointed out the scale of effort applied; in fact, this project acquired more high-speed tunnel time than many faster aircraft required before the actual flight of a prototype. Six complete wing configurations were examined, culminating in a 140ft wing of 2,500 sq ft area and 25 degrees leading edge sweep, a low thickness/chord ratio being chosen in order to achieve the desired Mach number. The work on the "64" was most instructive, and, as the market for a jet transport had still not developed in 1951, the company's design teams fell back to assess the overall position. The "64" was a good aircraft and one of the first to have a really sound undercarriage; it had also opened the way to necessary improvements in fuselage form, the original double-bubble giving way to a pure oval cross section.

Nevertheless, it had its shortcomings. Most of these stemmed from the thin wing, which not only caused manufacturing difficulties but made it impossible to accommodate the desired internal fuel capacity. During 1951 yet another new wing was laid out with 10 degrees more sweep (to the same 35 degree total as employed in the Boeing bombers) and consequently greater thickness; the area of 2,500 sq ft was maintained and the span reduced to 130ft. It was upon this wing that Boeing finally began to make plans for the construction of a prototype.

During the last months of 1951 the lessons learned both from "paper" and real aircraft were sifted and revalued and the amount of heavy-jet and tanker information obtained is still claimed to be unmatched by any other company. In particular, the company realized a most telling and encouraging fact: that the study of the art was then such that the requirements for a civil airliner and a military tanker/transport could be made by a single basic design with penalty to neither rôle. Thus was the way cleared for the financing of further developments, with the possibility of large military production offering an invaluable basis for commercial success. At a meeting of Boeing's board of directors in April 1952 $15m (£5,350,000) of stockholders' money was voted towards the development and construction of a proto-

STRATOTANKER . . .

type aircraft capable of fulfilling the combined requirements of a tanker for the Strategic Air Command, a cargo and passenger transport for the Military Air Transport Service and a medium to long range high-capacity civil airliner. Into this design was put all the relevant results of 5,000 hours of multi-jet research flying, 21,000 hours of project tunnel testing and the immense experience acquired during the manufacture and operation of several hundred jet bombers and large tanker aircraft.

It is now just two years since the end of the C-97 assembly hall in the company's Renton plant was walled off to form a private and self-contained bay in which the construction of a prototype was quietly begun at a short ceremony at which representatives of all branches of the company watched the driving of the first rivet. Construction was completed ahead of schedule a few weeks ago, and the finished aircraft was ceremonially rolled out on May 14th of this year.

The general layout of the new aircraft—which has the Boeing type number 367-80, and has also become known as Model 707—is clearly shown in the accompanying photographs. The engineering features of this aircraft are discussed below under a number of sub-headings.

On the left, Mrs. William E. Boeing breaks the champagne bottle, with William M. Allen, the Boeing president, looking on. The "roll-out" picture above provides some pod and undercarriage details.

Airframe.—Boeing have followed conventional stressed-skin, flush-riveted practice, carried to an extremely high pitch of development. Although the basic structure is generally of light alloy, most of the skin is in 75 ST, while the lightly stressed portions are almost entirely of magnesium alloy. Some of the skin is very thick by present airliner standards, the wing skin being seven-sixteenths of an inch between the spars, tapering to one-eighth inch at the tip. As a result, jigging and tooling is very extensive, every rivet and bolt hole being sunk to a tolerance of within a very few thousandths of an inch. The 128ft fuselage is almost entirely pressurized and the wing passes through it just beneath the main floor. The fuselage structure is very similar to that of the C-97 with closely spaced hoop frames leaving the interior quite unobstructed. The rear end of the pressure hull is covered with a convex dome and the external skin is applied in large sheets taking advantage of the fact that the smooth oval cross section eliminates the re-entrant portion seen on the C-97 and Stratocruiser. As the Stratotanker is an all-purpose demonstrator, large cargo doors are fitted on the upper deck. As these doors hinge outwards and upwards, and each have an area of at least 75 sq ft, they are a remarkable engineering achievement when it is borne in mind that the pressure differential is of the order of 9 lb/sq in. This means that the in-flight load on each door must be about 44 tons and the problems of obtaining a door frame of reasonable weight can possibly be imagined; furthermore, the doors must transmit flight loads just as though no doors were there.

Power Plant.—The Pratt and Whitney J57 is a high-compression, all-steel, two-spool, turbojet with a rated static thrust of 10,000 lb; it has been discussed in several past issues of *Flight* including that of May 14th last. The engine is in large scale production for military aircraft and can be regarded as fully developed and highly successful. The civil variant, styled JT3-L, is slightly different but is not yet available.

The engines are mounted in single pods, the configuration of which is the outcome of immense research. Each pod strut resembles a two-spar wing, each spar having an attachment at the lower end picking up the main mounting points at the top of the engines. When attached to the airframe *via* these pylons, the nose fairing is bolted to the intake of the engine itself and the pod is then completed by fitting two huge shell doors which form the skin of the pod itself. These doors are hinged along their upper edges and are clipped together along the lower centre line of the nacelle, so that the pod can be opened up to reveal the entire engine for maintenance purposes. The structure of the pod is in stainless steel and titanium alloy.

The bottom of each inner engine is no more than 28in from the ground, and the outers are at head height. The installation is fully protected against ice by hot air tapped from the rear engine compressor. Fire prevention is achieved by division of the pod into a number of sealed bays, each with its own extinguishing system; in addition the entire nacelle can be isolated from the wing by valves and shutters, the engine itself having an anti-windmilling brake as an additional safety measure. The Boeing thrust reverser (*Flight*, April 30th, 1954) is not fitted to the Stratotanker prototype but should be on production aircraft.

Taken in April, this photograph shows the prototype shortly before leaving the experimental bay in which it was built. Spoilers, cowlings and cargo doors are prominent.

Fuel System.—Owing to the considerable sweep angle of 35 degrees the Stratotanker wing has a useful thickness, especially at the root. As a result, it has been possible to accommodate a truly immense fuel capacity between the spars; in Imperial gallons, the tankage is as follows: outboard of the outer engines, 392 gal in each wing; between the pods, 1,808 gal; between the inner pod and the fuselage, 1,958 gal plus 1,540 gal. With a 3,500-gal overload tank in the centre section (actually in that part of the wing lying under the cabin floor), the total tankage is 14,896 gal; at 7.8 lb/gal this weighs some 116,000 lb.

All tankage is integral with the wing structure, the sealing being of a new type specially developed for this aircraft. All tanks are linked to permit pressure fuelling at rates of at least 400 gal/min, from a single point below each wing. A special high-capacity venting system is employed to accommodate the large vapour-release expected during rapid climbs to high altitude. No details can be given regarding tank purging, but—if Boeing practice with bombers is any guide—a form of inert-gas purging will be provided.

The present J57 engines are, of course, purely military. As a result, the specified fuel is JP-4 wide-cut gasoline or AvTAG; this is the only fuel so far cleared for use in the J57. It is possible that, were circumstances to require such a step, the

It is only when other aircraft are alongside, to give it scale, that the size of the Stratotanker can be appreciated; the aircraft in the background is a new Boeing KC-97G tanker/transport which, at 173,000 lb., is hardly a dwarf.

civil JT3-L engine might be re-rated to run on JP-1 kerosine. It should, at this point, be recorded that there is considerable American opposition to the use of kerosine as fuel. Whatever its advantages may be, it is considered a hazard from the point of view of explosive-vapour release at cruising height.

Aerodynamics and controls.—Boeing are certain that the wing of their new prototype is the optimum form for the job. Many years ago it was seen that the B-47 wing could be improved upon, and 21,000 hr of tunnel work—with every form of wing—eventually resulted in the highly efficient wing of the big B-52 bomber. The B-52 wing itself, in fact, bears quite a close resemblance to that of the Stratotanker although the latter aircraft has a more rigid wing structure which greatly reduces droop when on the ground.

Owing to this increased rigidity it has been found possible to employ fairly conventional ailerons near the wing tips; the whole control system is discussed below. Large double-slotted Fowler flaps are fitted in four sections; the slot effect being increased by providing a folding gap-strip ahead of the flap. The very high maximum lift coefficient produced by these flaps combines with a moderate wing loading to make possible comfortable operation from fields considerably smaller than are needed for the B-47, without the use of a tail parachute. This will be further assisted by anti-skid brakes and reverse thrust.

The wing profile varies continuously from the root to the tip and Boeing are convinced that this is the most efficient form of wing in the world, notwithstanding rival claims by our own industry. The sharp leading edge has thermal de-icing.

The entire flying-control system is manually operated. Boeing think this is very important to possible commercial operations and it is certainly a commendable achievement. Lateral control in cruising flight is achieved by the surfaces shown in the heading picture on page 697. Each wing carries two spoilers on the upper surface at about 70 per cent chord, their exact position being very critical if trim changes and buffet are to be avoided. These spoilers are power-operated and hinge about the forward leading edge, to increase drag and destroy the local lift. Quite big differential movements are employed in normal lateral control. As well as their differential use, the spoilers can also be combined together for use as air brakes, thus saving one set of surfaces over the B-52; in addition the main bogies are also stressed for use as air brakes, termed speed brakes in America.

Between the spoilers, and just outboard of the flaps, small high-speed flipper ailerons are fitted to the trailing edge, and these are used for lateral control in conjunction with the spoilers. Further outboard are conventional low-speed ailerons with spring tabs, which cut in automatically whenever approach flap is selected.

The tail is fairly conventional. The large fin folds flat to permit the use of a hangar with 18ft clearance; the moving tailplane has a large trimming range of at least $\pm$ 8 degrees and probably more, and carries conventional spring-tab elevators.

Landing Gear.—The sideways-folding bogie main undercarriage is attached to the rear of the inner rear spar and hinges inwards to lie in the thickened wing root and fuselage. Each bogie has four wheels which are smaller versions of the type employed on the B-52; anti-skid disc brakes are fitted, together with dimpled tyres at a pressure of about 135 lb/sq in. The nose gear is a twin wheel unit with hydraulic steering; it retracts forwards and, like the main gear, is housed in a well which is covered by doors when the gear is down.

Equipment.—The main cabin is 90ft long, 18ft more than that of a DC-6B. The floor is arranged to accept various types of seating, six-abreast being possible in the 130 passenger high-density version. Passenger transports would have a large number of small windows, these not only providing each passenger with some view but also being cheaper and lighter than fewer large windows. Boeing also considers such an arrangement "less apt to fail at high altitudes"; British constructors probably take a different view. The present prototype has hardly any windows at all.

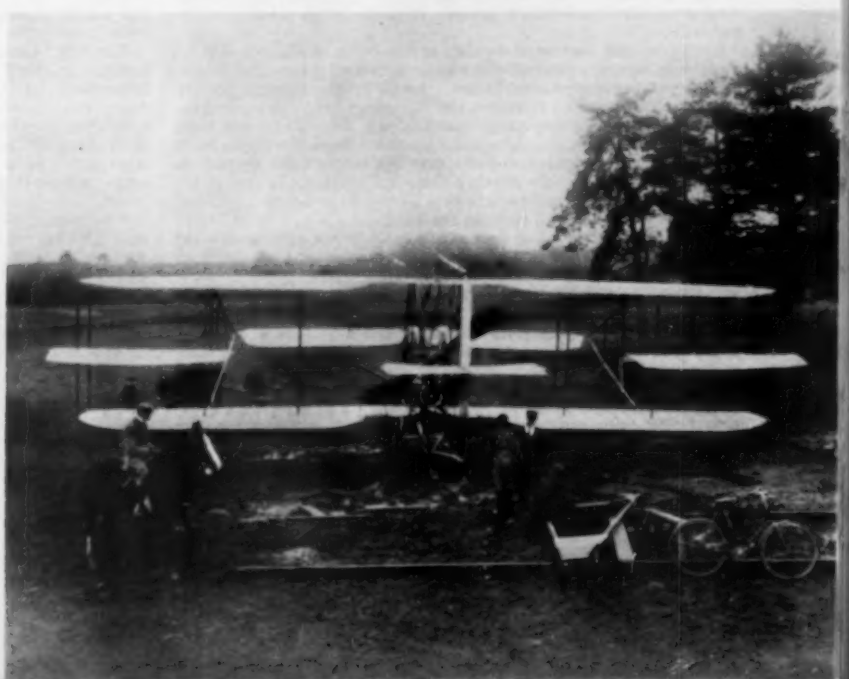
The main floor is stressed for cargo and the large doors show what can be done in this regard. In addition there is a big pressurized equipment and freight hold under the forward fuselage and another big under-floor luggage and freight com-

(*Concluded on page* 704).

Cody's "Flyer"

NEW PICTURES—
44 YEARS OLD!

THESE photographs, which should be of great interest to students of aeronautical history, are remarkable by reason of the fact that they have never previously been published. They were taken at Laffan's Plain, Farnborough, by Dr. A. P. Thurston, M.B.E., D.Sc., F.R.Ae.S. (who is still an aviation enthusiast at the age of 73), but it was not until a few weeks ago that he had the negatives printed for the first time. The pictures—Dr. Thurston is not certain of their date, but examination of various other photographs suggest it to be 1910—show the Cody biplane, which its builder was constantly modifying, at a time when it had a 65 h.p. E.N.V. engine driving a single airscrew. The front horizontal surface served both as elevator and—used differentially, as seen in the head-on view—as ailerons. Inter-plane ailerons were also employed. To demonstrate stability, Cody once flew with a man standing halfway along the port lower wing.



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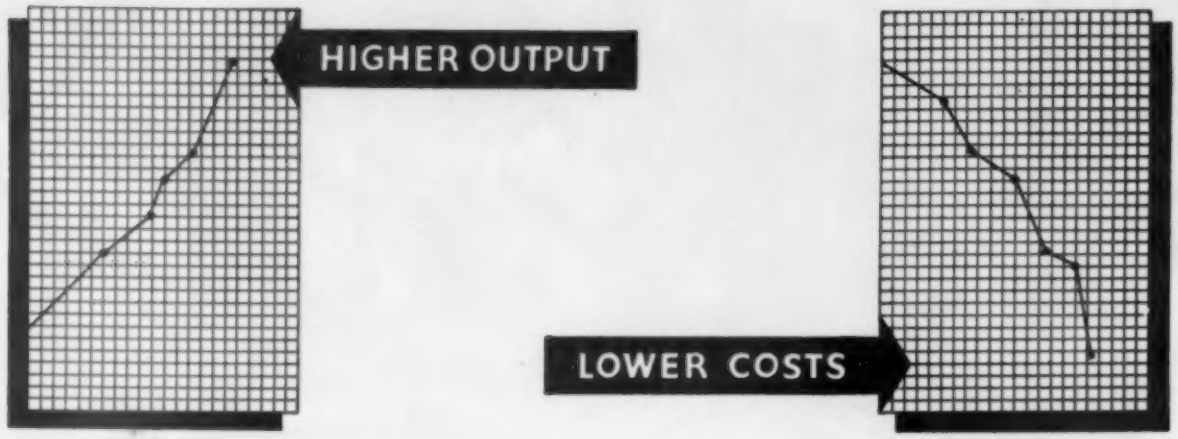

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The Choice of Engines: Dr. Russell's Wright Memorial Lecture *Part II*

LAST week we printed abstracts from the opening sections of the notable paper by Dr. A. E. Russell, D.Sc., F.R.Ae.S., F.I.A.S., which, with the title *The Choice of Power Units for Civil Aeroplanes*, formed the 42nd Wilbur Wright Memorial Lecture, given at the Royal Institution before members of the Royal Aeronautical Society. In the further abstracts which follow, the lecturer compares, in various characteristics, aircraft fitted with the contrasting types of power unit which he reviewed in his introductory passages. Dr. Russell is a director, and chief designer, of the aircraft division of the Bristol Aeroplane Co., Ltd.

Cruising Economy.—Much had been written by various authorities on cruise procedures suitable for high-performance turbine-engined aircraft, the most well-known factor to obtain fuel economy being the need to fly at high altitude. So the assumption that all suitable aircraft would cruise near, or above, the stratosphere needed no justification. This was a conclusion of some convenience because of the resulting simple relationships which governed the variation of engine power and fuel flow with altitude at constant true air speed and turbine r.p.m. Consequently, simple relationships could also be established for the aircraft and the factors in these equations permitted a fair understanding of the cruise economy problem.

The aerodynamic gains theoretically possible due to increasing aspect-ratio were not fully realized, because of a limitation on the maximum usable value of lift coefficient. It could be shown that for a given value of profile drag, if the same ratio of cruising speed to minimum drag speed was maintained, increased aspect-ratio implied a higher value of cruising lift coefficient. A finite limit was therefore imposed by the need to provide an adequate margin to cover manœuvres and turbulence without fear of buffeting or loss of control.

For a fixed value of C_{DO}, benefit was derived from increase of aspect-ratio despite the fact that this resulted in cruising farther away from the minimum drag condition. In addition, the improvement in L/D resulting from decreased profile drag and increased cruise lift coefficient was well marked.

For a fixed body size, C_{DO} was reduced by increasing the wing area. If the wing area was very large with a resulting low value of C_{DO}, high values of L/D could still be achieved when the aspect-ratio was as low as 3 and the aircraft cruised at, or near, minimum drag speed. These were the conditions appropriate to delta wing configurations.

The foregoing considerations dealt solely with the aerodynamic standpoint and certain of the conclusions needed qualification when structural effects were taken into account. For example, choice of aspect-ratio was governed by balancing the gains arising from higher lift/drag ratio against greater structural weight.

The most important features which determined wing weight were aspect-ratio, thickness/chord ratio, angle of sweep and wing loading. At first glance it appeared that a higher aspect-ratio could be adopted on a straight wing than on a swept wing, for in the latter case the structural span was increased by the sweep. However, the different permissible thickness/chord ratios within the limitation imposed by the drag rise tended to reduce this effect. This quality, however, could not be isolated from other important factors; notably wing loading, the use of high values always being advantageous partly by reason of an enhanced capacity to meet aero-elastic requirements.

Another significant effect from another cause, and which applied to all types of aircraft, was associated with the weight and distribution of the fuel carried. Structural strength in the flight cases was largely determined by the "tanks empty" condition. As a corollary, it was frequently found possible to increase the gross weight of an aeroplane with relatively minor structural alterations when such increase corresponded to a greater fuel load carried within the outer wing box.

To take all these effects into account when choosing each aspect-ratio was clearly an involved procedure. Fortunately, both experience and detailed analysis made elsewhere showed that, for the main purpose, precision in this instance was unnecessary, because the optimum value for a prescribed wing planform was not in fact sharply critical. It was only in the final stages of refinement that a second approximation for the best value of aspect-ratio became desirable.

So, in the interests of simplification, for wings with approximately 35 deg of sweep, an aspect-ratio of 6.5 would be used for podded engines, and 5 for buried engines. The L/D ratios were then approximately equal. A value of 8 would be used for straight wings. It was probable that these values were not unreasonable and would not unfairly penalize one type of aeroplane against another.

Effect of Engine Power on Cruise Economy.—When the separate relationships which controlled engine power and aircraft cruising conditions were combined together, and if certain major features of an aeroplane were known—namely, type of engine, body size and aspect-ratio,—a connection could be established between basic engine thrust, C_{DO} and cruise C_L. This could lead to an examination into a family of aeroplanes the essential characteristics of which, for example, might be as follows:—

Type of engine	Turbojet
Body size	Mean diameter 12.5ft Length 135.0ft
Aspect-ratio	5.0
Design cruise speed	0.85 Mach number
Cruise lift coefficient	0.30

With these data in mind it was apparent that, when larger engines were fitted, in order to satisfy the conditions of constant speed and lift coefficient the operating altitude and the wing area was increased. It followed that with constant body size, C_{DO} was reduced while cruising L/D ratio was increased. It was also true that the speed for minimum drag approached closer to the cruising speed. By reason of the constant value of lift coefficient, wing loading was proportional to relative density.

Drag estimates might now be made by standard methods. The body size was fixed, and appropriate wing sweep, thickness/chord ratio and tail surface areas could be selected. Then the product of wing loading and power loading might be plotted against altitude for a number of different sizes of engine (see Fig. 5). As this product was, to a first approximation, a measure of take-off distance, the curves showed that, in general, the longer the take-off run, the lower would be the initial cruising altitude.

Take-off Performance.—Two constant values of the product of power loading and wing loading in Fig. 5 corresponded roughly to "balanced field lengths" of 6,000ft and 8,000ft, i.e., when the distance from start to clear a 50ft screen, after an engine failure at take-off, was equal to that required to decelerate and stop.

Besides power loading and wing loading, the balanced field length was also affected by the take-off safety speed of an aircraft and the temperature and altitude of the airport. Fortunately there was no need to indulge in complicated arithmetic to calculate these distances, for it could be shown from statistical evidence applying to modern transport aeroplanes, that a good enough approximation to the field length required was given by the formula:—

$$\text{Take-off distance} = K w_S w_O / \sigma C_{L\,max}$$

where w_S = wing loading
w_O = power loading
σ = effective relative density
K = 38

Aircraft Weights.—Rather than use some particular set of formulæ for estimating the weight of various components of the structure for a large number of aeroplanes, a generalized approach had been adopted. Weight formulæ which included the

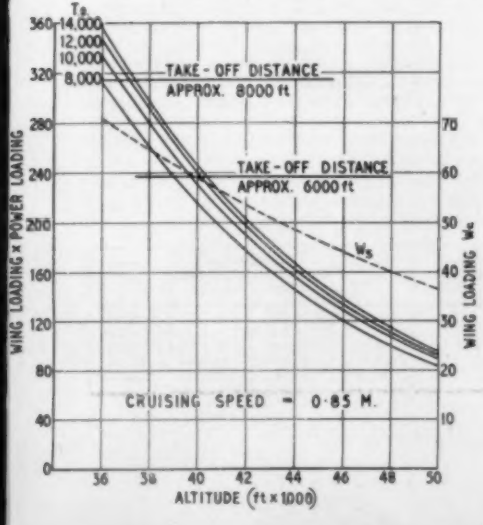


Fig. 5. Variation of initial cruising altitude with wing loading, and with wing loading × power loading. This product is to a first approximation a measure of take-off distance.

POWER FOR AIR TRANSPORT . . .

effect of all possible design variables were too cumbersome to handle other than for checking final specific layouts. Also, for the present purpose one was not concerned with detail weight breakdown, but only in establishing reliable trends within a related set of completely furnished and equipped aircraft. In support of a generalized approach it could be demonstrated from available weight data that, while there was considerable variation in the component weights of different aircraft, surprisingly consistent values for the complete article could be deduced with the aid of quite simple correction factors.

In the end results, although it was desirable that the final aeroplanes emerging from this analysis should each be reasonably close to those found by a full individual engineering study, complete reality was not essential. The prime objective was to show relative sizes of aircraft when fitted with different types of engine, in each case the size of body and the load carried being the same.

For weight estimation, all the aeroplanes considered might be split into four main elementary groups:—

(1) W_C, a constant weight which was determined by the condition necessary to carry the specific load.

Items in this group included the complete furnishings, soundproofing, air conditioning, flying, navigational, radio and emergency equipment; the crew and the payload.

The size of the body, already used in the drag estimates, was such as to provide rather better than present-day standards of comfort, with crew rest places and, obviously, crew stations. Clearly much of the body structure would be independent of aeroplane gross weight, although the exact proportion was uncertain. Several values were tried and a reasonable compromise was found to be given by 8,000 lb + 0.025 W_G, where W_G was the aeroplane gross weight. Then, as examples, for two widely separated gross weights, 120,000 lb and 240,000 lb, the percentage body weight was 9.1 and 5.8 per cent respectively.

The whole group denoted by W_C amounted to 45,000 lb, including 8,000 lb of body structure weight.

(2) W_S, the remainder of the structure which varied with W_G. This group included the wings complete, the tail unit and undercarriage, the fuel and hydraulic, electric and other systems.

(3) W_E, total installed engine weight. This could be taken as proportional to the engine design mass flow necessary to produce the required thrust. The constant appropriate to the type of engine employed must be taken.

(4) W_F, fuel weight, which was the difference between the gross weight and the sum of the weights in groups (1), (2) and (3).

Then the gross weight $W_G = W_C + W_S + W_E + W_F$.

After describing the method of application of the range/gross weight calculations and before passing on to further aircraft analysis with different types of engine, Dr. Russell summarized the conclusions to be drawn from the foregoing discussion.

From the initial general aerodynamic considerations, it was suggested that the trend for maximum economy would favour larger aircraft with powerful engines flying at high altitude at the maximum available cruise lift coefficient, having wings of the highest possible aspect ratio.

Taking the argument a stage farther and making reference, although not in detail, to previous work, it was concluded that when the effect of wing structure weight was considered, the trend shown by the aerodynamic analysis was misleading on the question of aspect ratio.

By advancing the argument still farther and citing examples in the design of jet aircraft, it was found that, although in fact the trend towards the large aeroplane was correct in relation to the cruise lift/drag ratio, while also leading to lower wing and power loadings, and hence improved take-off performance, the consequent structure weight penalities in the larger aeroplane incurred an overall loss in fuel economy.

The most economic aeroplane was therefore one with high wing and power loading, which would not fly very high and had the worst acceptable take-off performance. This was another way of saying that the smallest and lightest aeroplane for a given duty was the most efficient.

Effect of Type of Engine.—The point had been made that a high ratio of take-off thrust to cruising thrust was an advantage and an attribute to be added to the engine characteristics affecting aircraft economy.

Table III. Approximate gross weights for four alternative types of aircraft (payload 25,000 lb) intended for the North Atlantic route.

Route	Stand-off	Turbo-jet	Ducted Fan		Turbo-prop
			λ=0.75	λ=2.0	
London-New York	1 hr	215,000	194,000	192,500	162,500
	2 hr	239,000	209,000	204,500	170,000
Amsterdam-New York	1 hr	224,500	203,000	201,000	166,000
	2 hr	248,500	218,800	212,500	173,500

The basic engine data showed the turbojet engine to have the lowest value of T_S/T_O (where T_S = static sea level thrust; T_O = thrust/relative density at the tropopause), somewhat less than unity, and the turboprop engine to have the highest value, considerably in excess of unity, ducted fans lying intermediate according to their by-pass ratio. But the effect of this and other engine characteristics on aircraft performance emerged when analyses similar to that already made were followed.

Aircraft Analysis.—Attention could first be given to aircraft fitted either with turbojet engines or with ducted fan engines, in the latter case with alternative by-pass ratios. The figures applying to the root installed turbojets were the same as those derived earlier. In the case of the two aircraft with engine pod installations advantage had been taken by employing a higher aspect ratio.

A number of interesting conclusions could be drawn from the calculations:—

(1) From the performance point of view, for turbojet aircraft cruising at 0.85 M, there seemed little ground for controversy as to whether engines should be buried in the wing root or slung in pods. For the present purpose, there seemed no need to differentiate between the two arrangements (although personal recollections suggested merit in uninterrupted space around the engines).

However, for ducted fans the greater pod dimensions necessary to house the engine imposed a relatively greater drag penalty, which was reflected by adverse trends in gross weight, engine power and fuel required.

So, in deference to many susceptibilities, no further reference needed to be made to pods, and buried engines might tacitly be assumed.

(2) The possible reduction in aircraft gross weight by using ducted fan engines was disappointing, especially at the longer ranges. At the minimum gross weights, which were related to the worst take-off performance and the smallest acceptable size of engine, the proportion of fuel required was adversely affected by a lower operating L/D ratio.

It seemed that a more attractive aeroplane might be had by using a larger engine, so permitting a lower wing loading. A significant improvement in take-off performance followed with quite a small increase in aeroplane gross weight and a small reduction in the amount of fuel required.

(3) Somewhat surprisingly, it appeared that the use of the higher by-pass ratio did not lead to lower aircraft gross weight. In effect, at any given cruising range the combined weight of engine plus fuel remained substantially constant. From this it might be inferred that the aeroplane empty weight less power plant also remained unchanged.

(4) Aeroplanes with ducted fan engines could, with advantage, be given a better take-off performance than could those with turbojets. Specific aeroplanes from the group would not be identified for economic analysis until the appropriate still-air ranges which fitted certain operational route conditions had been established.

The same methods could again be applied to derive a family of aircraft fitted with turboprop engines. For these aircraft a straight wing was selected; at the lower cruising speed and with substantially smaller quantities of fuel, sufficient volume could be provided within the wing, even at a thickness/chord ratio which satisfied the aerodynamic drag rise condition at zero sweep-back. An aspect-ratio of 8.0 was chosen after a structural analysis had shown this value to be consistent with the structure weight data.

The same characteristic curve profiles (to which by now we should have become accustomed) could be observed. For the turboprop aircraft an additional factor had to be taken into account. When the design was adjusted to the maximum field length, the high propeller thrust resulted in a rather high wing loading. As the proportion of fuel required for a given range was lower than that for the other engines, it followed that the wing loading in landing was substantially higher than the values applying to the other aircraft. Although a better lift coefficient could be achieved with efficient flaps on a straight wing, the approach and touch-down speeds were greater than those in the other cases. While advantage might be taken from reverse thrust

Table IV. Relative weights for turbojet, ducted fan, and turboprop aircraft designed to carry 25,000 lb payload and sub-normal fuel reserves on the London-New York route.

Engine	Turbo-jet	Ducted Fan		Turbo-prop
		λ=0.75	λ=2.0	
Gross weight (lb)	215,000	194,000	192,500	162,500
Cruising speed (m.p.h.)	560	560	560	500
Power unit weight (lb)	15,600	15,400	17,400	19,800
Airframe weight (lb)	74,450	66,500	67,300	61,300
Fuel weight (lb)	98,500	84,700	81,300	54,600

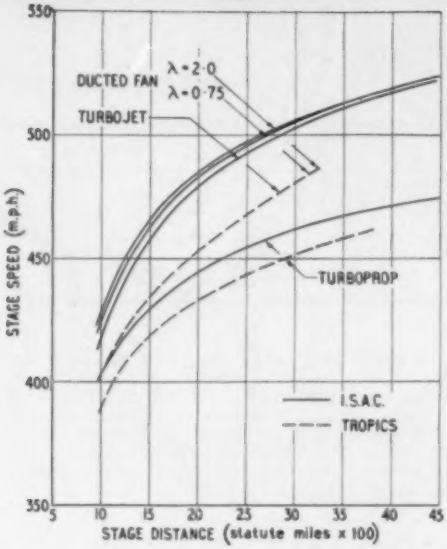


Fig. 6. Variation of operating speed with stage distance, for standard and tropical conditions.

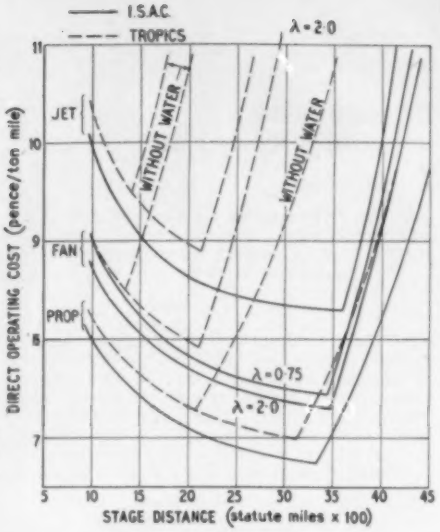


Fig. 7. Economic data. Direct operating costs, calculated by the S.B.A.C. method, for the various aircraft types and conditions.

when on the ground, from a safety aspect, a relative disparity in airborne performance was undesirable. Accordingly, the small sacrifice in operating economy, consequent upon designing for a 6,000ft field length instead of 8,000ft as hitherto, had to be accepted.

A further step was necessary before true comparison between types could be made. In particular, it was well known that some forms of engine lacked flexibility and were more extravagant than others when operating at "off design" conditions.

There was no rigid code for assessing fuel reserves, each airline adopting a different system. Some insisted on the maximum probability of landing at the terminal. A decision to divert to an alternative could be highly inconvenient and expensive, so the aircraft must descend to low altitude so as to allow a proper judgment to be made. Also, the view was held that changing the type of engine did not justify a reduction in the time allowed for stand-off, a time backed by experience.

The North Atlantic.—Argument might be advanced more conveniently by reference to a particular route, and that with the greatest international interest was the North Atlantic. The first question to ask was which airport should be taken as the eastern terminal? If the aircraft was to be designed to start from London, then those airlines which started from Copenhagen, Amsterdam, Brussels or Paris might possibly find a more attractive proposition in a competing stable; and if continental operators demanded the usual two hours stand-off at New York, then a product groomed for light going would flounder on tougher courses. This was an aspect which must be faced, for in both local and national interests it was necessary that the potential market should be as large as possible.

So the most severe requirement which might be considered was as followed:—Distance between terminals 3,700 miles, headwind 77 m.p.h., two-hour stand-off at New York, descent to sea level, diversion to Washington. This seemed calculated to eliminate turbojet aircraft. Some alleviation was found by allowing the stand-off to be made at 20,000ft and diverting from that altitude. The least requirement which might be entertained was—distance between terminals 3,450 miles (i.e., London-New York), headwind 77 m.p.h., one-hour stand-off at 20,000ft and diversion to Washington. If a two-hour stand-off proved essential, then with adequate warning the payload could be reduced and more fuel carried. Prospects of foreign sales receded into the background.

The different rates of growth in the aircraft's gross weight with increased duration were obvious. At around 5,500 miles still-air range these were for the turbojet, ducted fan (by-pass ratios 0.75 and 2.0) and the turboprop aircraft, 4,700 lb, 3,800 lb, 3,600 lb and 1,700 lb per 100 miles range respectively.

Although in practice it was probable that the more severe requirement for fuel reserves would be demanded, the lower standard would be assumed, although this was inadequate for regular Atlantic operation. Adopting this line weighted the scales in favour of turbojet aircraft, the evidence from the ensuing balance presenting a concession where one was most needed.

Table V. Comparative direct operating costs for the four types in Table 4. The economy claimed for the turboprop by the lecturer is apparent.

Engine	Turbo-jet	Ducted Fan		Turbo-prop
		λ=0.75	λ=2.0	
Direct operating cost				
(pence per ton-mile) ...	10.85	9.70	9.57	8.85
(pence per seat-mile) ...	1.04	0.93	0.92	0.85
Ratios	1.23	1.10	1.08	1.00
Fuel cost per year (£) ...	374,000	326,000	307,000	206,000

Operating Costs.—The dominant features of the four aircraft which had been evolved for an assessment of operating costs were shown in Table IV.

The standard method developed by the S.B.A.C. was employed.

A literal application of the method produced a result which at first sight appeared to give an over-estimate of payload. This was due to the volumetric capacity of the holds allowing freight to be carried in addition to passengers' baggage. In a sense this gave a somewhat fictitious seat-mile cost, for each unit of payload was assumed to carry the same value whether it be mail, freight or passenger. For ranges at which this full volumetric payload could be carried, the operating cost per ton-mile would be lower than on a non-stop Atlantic operation where the payload was limited performance-wise to 25,000 lb.

Some variation on the standard S.B.A.C. method regarding annual utilization would be logical. With a speed of 500 m.p.h., a daily return trip was entirely feasible. Slightly higher speeds would not permit additional journeys without excessive timetable complications, and only certain hours of the day could be considered as acceptable times of departure. So instead of taking an annual utilization of 300 hours, a certain number of daily round trips should be assumed. If one was out to show a potential substantial reduction in Atlantic fares, then around 300 days might be used. An average fleet utilization of 4,000 hours per aircraft had been exceeded by several operators where suitable route conditions existed. But in the present case our interest was in comparing possible alternative aeroplanes. Circumstances were equal if a modest operation on four days a week was assumed. This led to an annual utilization of approximately 3,000 hours.

As regards engine and airframe prices, after the first shock one recovered on finding that the variation between different manufacturers was not so great after all. Levels which should be used in ten years' time could be little more than a guess. As a purely tentative shot, and with a disclaimer to guard against quotation, the power plant and equipped airframe had been taken as £9 and £10 per 1 lb weight respectively.

Results.—(1) When carrying 25,000 lb payload and sub-normal fuel reserves for the London-New York operation, aeroplanes with different types of engine would have the proportions and direct operating costs shown in Tables IV and V.

(2) If the aircraft must provide for normal fuel reserves, these differences would increase. Alternatively, if in the same aeroplanes extra fuel was carried to permit a two hours' stand-off in winter conditions, then the payloads must be reduced to 17,700 lb, 19,000 lb, 20,000 lb and 21,250 lb in the same order as arranged in Table IV.

(3) If the designs must have the capacity to meet foreign operators' requirements, the differences were again increased.

(4) The block air speed for the turbojet and ducted fan aircraft was 510 m.p.h., giving an average time for the return trip of 13.5 hours. The comparable figures for the turboprop aircraft were 468 m.p.h. and 14.7 hours respectively.

(5) Naturally many other questions arose, more particularly passenger comfort, noise at airports, and ice-covered runways, but these could be left for debate in less sober places.

A consideration of tropical conditions (sea level temperature I.S.A.C. + 30 deg C, altitude temperature for cruise I.S.A.C. + 15 deg C, field length 7,000ft at sea level) and the consequent effects of temperature on engine performance and cruise technique, gave the results shown in Figs. 6 and 7 and Table VI.

Conclusions.—The main conclusions of this analysis were illustrated in Tables IV, V and VI. An examination of these would

POWER FOR AIR TRANSPORT . . .

Table VI. Tropical performance over a 2,500-mile stage-distance. The advantage of using water injection is striking, especially for the turbojet and the ducted fan.

Engine	Turbojet		Ducted Fan (λ=2.0)		Turboprop	
Water injection ...	with	without	with	without	with	without
Take-off weight (lb.)	184,000	167,000	164,000	150,200	159,000	146,800
Payload (lb.) ...	28,000	14,100	28,300	17,800	33,600	29,500
Cruise speed (m.p.h.)	531	531	531	531	489	489
Stage speed (m.p.h.)	468	468	468	468	443	443
Pence/ton-mile ...	10.2	20.1	9.2	13.9	7.1	8.1
Pence/seat-mile ...	0.98	1.93	0.88	1.34	0.68	0.78
Ratio	1.43	2.50	1.29	1.70	1.00	1.00

show that the pure jet was the engine least well-suited to the requirements of civil aviation. By comparison with other types its adoption led to the largest, heaviest and least economic aircraft. If the highest speeds were essential, then ducted fan engines were better. Apparently the value of by-pass ratio was not critical; an optimum probably lay somewhere between 0.75 and 2.0 but was obviously a function of design stage-distance.

When the excitement of a new form of propulsion had abated, the realization of the greater potential capacity of the turboprop engine for civil aviation would be universally accepted. In the future, aircraft fitted with this type of engine would form the substantial proportion of the fleets of all airlines. For any given duty they would be smaller, lighter, more economic and versatile than any other kind. Even on long journeys, the time differential with possible competing types would be so small that the chance of solvency offered better attractions.

THE NATIONAL AIR RACE DISPLAYS

THE Royal Aero Club has released details of the two-day "Fifty Years of Flight" display programme to be held at Baginton, Coventry's civic aerodrome, in connection with the National Air Races on Friday and Saturday, June 18th and 19th.

The display events on the Friday will begin at 7 p.m., after the finish of the Royal Aero Club International Trophy Race, the 28 entries for which we listed on May 14th. A Blériot XI monoplane (1909 "cross-Channel" type) will be flown, together with a 1911 Deperdussin monoplane and the 1912 Blackburn monoplane. The 1914-18 war period will be represented by a 1915 Sopwith Pup and 1916 Bristol Fighter. Next will follow a transition—somewhat abrupt, perhaps, to the jet age: a Meteor of the Central Flying School will perform individual aerobatics, followed by a formation flight by four Canberras of Bomber Command. The R.C.A.F. will present Sabres, a single aircraft giving an exhibition of aerobatics and four performing aerobatics in formation.

A Hawker Sea Hawk fighter will be demonstrated by a pilot of No. 898 Squadron, Fleet Air Arm, and to this item the little Saro Skeeter helicopter and the Auster Aiglet Trainer should provide a good contrast. Friday's programme will end with a strongly Continental flavour, contributed by four French aircraft —the Hurel-Dubios H.D. 31 and three ultra-lights, the Jodel Bébé, flown by Capt. Moulene; the Turbulent, piloted by its designer, M. Roger Druine; and the Minicab, flown by M. Albert Rébillon, who with this aeroplane holds the closed-circuit distance record of 1,243 miles and several speed records in Class C.1a. The programme will end about 9 p.m.

On the Saturday, proceedings will start at 3 p.m. with an ascent by a free balloon, *Card 1*, which was flown on the South Bank of the Thames during the Festival of Britain in 1951. All Friday's events will be repeated, with the addition of a fly-past which, representing the development of the light aeroplane, will include the 1924 Hawker Cygnet (the oldest aircraft registered in this country), the famous D.H. Cirrus Moth of 1925, the 1929 Hawker Tomtit—which will probably be flown by S/L. Neville Duke—and a Percival Gull, the actual machine in which Miss Jean Batten made her famous flights of 1935 and 1936. The 1939-45 war, and the period immediately preceding it, will be represented by the one remaining Hawker Hart, a Gloster Gladiator, a Fairey Swordfish, a Hurricane, Spitfire and a Lancaster.

At about 4.25 p.m. the 22nd King's Cup Race (open to the first 15 British pilots in the previous day's contest) will be flown over four laps of a 17-mile closed circuit. Jet aircraft will then perform again, and at 6 p.m. time will be kept for some "surprise items." There will be public joy-riding facilities at Baginton on both days.

Tickets for the reserved public enclosure are now available, on written application to the Town Clerk, Council House, Coventry, or on personal application at the Council House information bureau or at Godfrey's Travel Agency, Pool Meadow. Tickets for the Friday are 2s (adults) and 1s (children under 15); for the Saturday they are 4s and 2s. There is no advance sale of tickets for the general public enclosure, admission to which will be 1s (adults) and 6d (children under 15) on the Friday and 2s and 1s on the Saturday. The car-parking charge will be announced later.

STRATOTANKER (Continued from page 699)

partment in the rear, behind the bogies. These holds are provided with various access doors and a small ladder leads from the forward compartment up to the flight deck, supplementing the normal method of crew-entry, level with the main floor. The prototype also has an emergency escape hatch from the flight deck on the lower port side of the nose, seen open in the bottom picture on page 698.

The cockpit is very attractive and is laid out for side-by-side pilots. The engineer normally would sit behind the first officer (second pilot) with a large wall panel which, if necessary, can be swung round to face forwards. In the latter condition, the panel can be handled by the first officer, so reducing the flight crew to two. All instruments are miniaturized, and the view through the large flat windows is unusually good. Very considerable radio equipment is carried, including cloud/collision warning equipment beneath the large nose cap.

Fuselage pressure is obtained by bleeding air from the first compressor on each of the four turbojets. This air is passed through the usual humidifiers and filters and is cooled by expansion across a small turbine.

Conclusion.—The present prototype is simply a research and demonstration aircraft, designed to show what can be done in both military and civil rôles. Clearly, the biggest immediate orders are likely to come from the U.S.A.F.; nevertheless, one may conclude from the colour scheme—lemon yellow, white, silver and chocolate—that commercial appeal is not being neglected. There is, at present, no indication of flight-refuelling gear. In the KC-97, the Boeing "Flying Boom" refuelling equipment could be inserted as a self-contained pack, replacing the rear cargo doors and ramp. Possibly, the higher cabin pressure will prohibit such an arrangement on the jet aircraft.

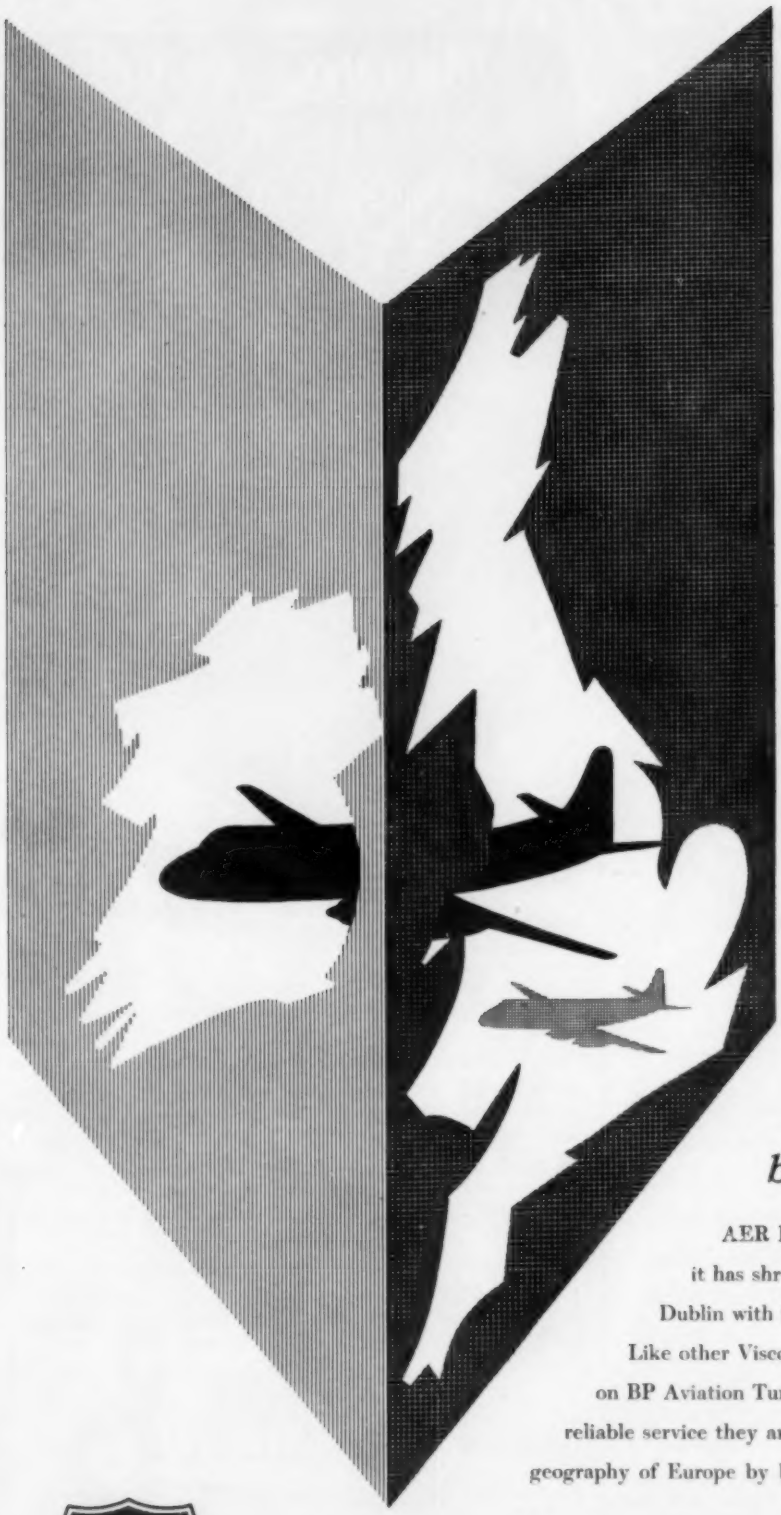
In airline service the Stratoliner would carry from 80 to 130 passengers, cruising at 30,000 to 40,000ft, and reaching this height in 20 minutes. The direct cost per mile would be about double that of the DC-6, but provisional calculations show that the Boeing could do three times as much work in a given time as the piston-engined aircraft. Although the best stage length is 1,200 to 2,800 miles, the Stratoliner is undoubtedly a direct trans-atlantic machine for some 90 per cent regularity, with a New York/London time of under seven hours.

The Editor saw the Stratotanker at Renton a few weeks ago. He writes: "My own opinion is that this is a very serious civil as well as military proposition; it a very promising aircraft indeed, and should not be under-estimated."

SUPER CONSTELLATION ORDER-BOOK

AN official, up-to-date list of all firm orders placed by civil operators for Lockheed Super Constellations was received from America too late for inclusion in last week's Commercial Aviation issue of *Flight*. For the record, we reproduce the list below. It shows that 18 different airlines have ordered a total of 139 Super Constellations; of these more than half have been delivered. Production has now reached a rate of about 5 aircraft per week.

Eastern Air Lines, 30; Seaboard and Western Airlines, 4; Trans World Airlines, 30; K.L.M., 13; Air France, 10; Pakistan International Airlines, 3; Quantas Empire Airways, 8; Trans-Canada Air Lines, 8; Compania Cubana de Aviacion, 2; Air-India International, 5; Iberia, 3; Avianca (Colombia), 3; Linea Aeropostal Venezolana, 2; Varig (Brazil), 3; Northwest Airlines, 6; Thai Airways Company, 2; Transportes Aereos Portugueses, 3; Luftag, 4.



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Type Symbol: 12 QP6 - 4S *Designation:* 24 v. 40 a.h.

Dimensions (overall): 12¼ long x 11 11/16 wide x 10½ high

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"Flight" photographs

The G.F.A. chlorobromomethane equipment mounted on a Land Rover and (right) seen in action at the Bovingdon demonstration described below.

"C.B." AGAINST FIRES

AS we briefly recorded last week, a convincing demonstration of the properties of "C.B." (chlorobromomethane) as a fire-extinguishing medium was given recently at Bovingdon Airport. It was staged by the General Fire Appliance Co., Ltd. (11 Waterloo Place, London, S.W.1), who have introduced and pioneered in Britain the use of this chemical as a means of combating fires involving highly volatile oils and solvents, and who produce the necessary equipment for applying it in the most effective manner. The American Forces in Western Europe have ordered a number of sets of the equipment—these have already been delivered by B.E.A. to Holland, where they are being installed on U.S.A.F. fire-fighting vehicles; and, we learn, the Air Ministry are also recommending the use of C.B. by the R.A.F., following extensive trials.

The equipment used in the Bovingdon demonstration was the G.F.A. C.B. 240 type, very similar to that adopted by the U.S.A.F. Mounted on a Land Rover—typical of the light, fast type of vehicle which can be employed—it consisted of two 12-gallon containers of C.B., delivery pressure being supplied by a small cylinder of nitrogen, at 100 lb/sq in, mounted above each container. Two hose-lines and reels completed the equipment, though mention should be made of the applicators; these, the design of which has involved considerable research, ensure that the C.B. is sprayed in a cone of precisely determined shape, with the chemical atomized into droplets of controlled size.

At Bovingdon, a mock-up of a metal aircraft was built in a depression into which 150 gallons of oil and petrol were poured, further petrol being gravity-fed from a pipe while the fire was in progress. When the blaze had reached its maximum intensity the two hose-operators (wearing, so far as fireproof clothing was concerned, only light asbestos jackets and helmets with visors) went into action. It was noticeable that they were very quickly able to attack the fire at almost arm-length range and, after 15 seconds' application of C.B., the flames appeared to be sufficiently subdued for a rescue from the cockpit section to have been effected. A further 18 sec—making 33 sec in all—sufficed to extinguish the fire completely, and there was no flashback or re-ignition. Only about seven gallons of C.B. had been used for the complete operation.

In a two-day series of demonstrations before M.T.C.A. and Air Ministry representatives at Cardiff Airport last January, comparative tests were made with C.B., CO_2 and foam. Records of the results suggest that the performance of the C.B. equipment, particularly in speed of extinction, was outstanding.

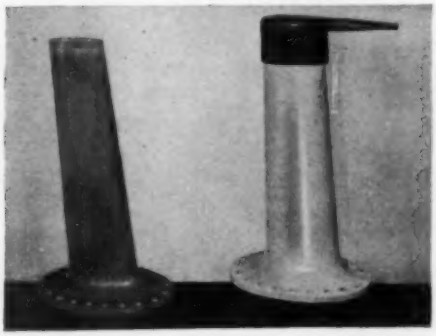
REINFORCED-PLASTIC AERIAL MASTS

ILLUSTRATED below is an aircraft aerial mast which formed part of the exhibit of Chelton Electrostatics, Ltd., of Marlow, Bucks, in the plastics section of the recent British Industries Fair.

Typical of the range of masts produced by this company, it is A.R.B.-approved for use with M.F. and H.F. equipment in both pressurized and unpressurized aircraft. The aerofoil-section shell is a glass-fibre laminate bonded with polyester resin and protected from erosion by no fewer than ten coats of neoprene paint, to a thickness of approximately 0.01in. The black polythene head-cap is moulded directly on to the shell, and the lead-in assembly is embodied in the moulding, so that the lead-in is completely insulated in polythene from the point of connection of the aerial to the transmitter terminal.

The 17in mast—other typical lengths are 7in and 12in—is designed to support an aerial having a working tension of up to 70 lb and equipped with a weak-link insulator at the after end. Applied at an angle of not more than 15 deg to the fore-and-aft axis, the breaking load of the mast itself is 500 lb. In electrical tests, the breakdown voltage was found to exceed 20 kV.

Chelton Electrostatics also make a range of aerial insulators, and another of their aircraft specialities is the "Driwik" static-electricity discharger, illustrated in *Flight* of June 5th, 1953.



A Chelton aerial mast; on the left is the shell, moulded from resin-bonded glass-fibre laminate.

FOR CARBON REMOVAL

AN extremely powerful decarbonizing agent is now being marketed by Bennett (Hyde), Ltd., Boston Mills, Hyde, Cheshire. Known as Gunk Compound Hydro-Seal, it is claimed virtually to "do the impossible" by dissolving—or, at any rate, digesting—the hardest carbon deposits from aluminium-alloy pistons, cylinder heads and other engine components.

It can be used either cold or hot, the action in the latter case being approximately doubled in speed for each 10 deg F rise in temperature to a maximum of 100 deg F.

An important feature of the compound is the sealing medium which it contains. This is a glycerine-like, water-based fluid which, floating on the active agent, prevents evaporation-loss; it is stated, also, to prevent the escape of vapours which might be inhaled, to reduce inflammability, and to prevent the chance of the active agent splashing into the operator's eyes or on to his skin.

Hydro-Seal is sold in containers which incorporate a dipping-basket, and a one-gallon supply of "rejuvenating" liquid can be supplied as an extra item. For users with large-scale dipping facilities, Hydro-Seal is also available in 10- and 45-gallon drums.

THE INDUSTRY

G/C. Allerston Joins Cossor

IT is announced that G/C. P. Allerston, O.B.E., M.I.E.E., who recently retired from the R.A.F., has been appointed manager of the equipment servicing department of A. C. Cossor, Ltd. He will be responsible for the installation and maintenance—both home and overseas—of the firm's large and small airfield control radar, their Gee ground and airborne equipment, and other products in the radio and radar fields. His main duties at the outset will concern the formation of a nucleus of servicing engineers, particularly those experienced in ground-approach systems.

G/C. Allerston

G/C. Allerston, after evacuation from France in July 1940, served for the period of the war at the Air Ministry and H.Q. Bomber Command. He was concerned in the inauguration of the original Gee programme which was later to play such an important part in the bomber offensive over Germany. He has had long experience in servicing R.A.F. equipment and was Deputy Director of Radio Engineering (Air) at the Air Ministry from 1946 to 1949.

Ex-R.A.E. Pilot's Appointment

IT is announced that Mr. R. J. Foster has been appointed by the British Oxygen Co., Ltd., as their liaison officer with the aircraft industry, with the Services, and with Government departments.

Holder of the D.F.C. and A.F.C., Mr. Foster served during the war as a night-fighter pilot in the United Kingdom, Malta and France with Nos. 604 and 108 Squadrons. In May 1945 he joined the R.A.F. test-pilot staff at R.A.E., Farnborough, where he was Squadron Leader i/c Aerodynamics Flight from December 1945 until his demobilization in May 1946. After taking a degree in Mechanical Sciences at Cambridge, he joined the British Oxygen group.

Rotary-barrel Finishing

FROM Roto-Finish, Ltd., 39 Park Street, London, W.1, come details of the various machines which they supply for the finishing, by the rotary-barrelling process, of precision parts. The range extends from a machine capable of mass-processing very small machined parts, such as those used by the instrument industries, to one designed to handle large components of up to approximately 26in x 22in. In the latter instance, though the basic principle is the same, making use of processing chips and compound, the component is held in a simple jig which is slid into the barrel on guide-rails.

MR. L. T. P. BANBURY, secretary to Dowty Equipment, Ltd., and a number of their subsidiaries, has been appointed to the Board of Dowty Group, Ltd.

MR. JOHN CREEK, who joined Fibreglass, Ltd., of St. Helens, Lancashire, as general sales manager in May 1952, has been appointed sales director.

High Pressure Components, Ltd., Changes Hands

THE business of High Pressure Components, Ltd., manufacturers of "Gyp" hose couplings and assemblies, aircraft high-pressure couplings, and specialized charging valves, has been acquired by Mr. H. W. Bowen, O.B.E., a former managing director of E.M.I. Factories, Ltd.

Mr. Bowen, as chairman of the new company under his control, has been joined as a co-director by Sir Wolstan Dixie, Bart. Large-scale expansion is planned, including an entirely new factory to replace the present works at Hampton Hill. The company is shortly to enter other fields of aircraft-component production.

Mr. Bowen has had a distinguished career in production engineering. He was for four years on production work with the Ford Motor Co., and for seven years an executive with Vickers-Armstrongs. He was associated with E.M.I. for 13 years, primarily as production manager and eventually for five years as managing director of E.M.I. Factories, Ltd. He is a director of Air Trainers, Ltd., and of Clark Matthew, Ltd.

Special-Purpose Lubricants

THE firm of Rocol, Ltd. (Ibex House, Minories, London, E.C.), the Ragosine subsidiary formed recently to manufacture and distribute special-purpose lubricants and compounds, have published leaflets dealing with anti-scuffing paste and oil (a handy means of applying molybdenum disulphide for "dry" lubrication); R.T.D. cutting compound; molybdenized lubricants; watch and clock oils (suitable also for instruments, and including synthetic oils efficient down to a temperature of −65 deg C); and Kilopoise lubricants (extreme-viscosity oils for motion-damping and sealing) and locking compounds for soft-iron cores in electric components.

IN BRIEF

The engineering division of International Aeradio, Ltd., has moved from Bovingdon to premises alongside the Aerad printing and publishing division at Hayes Road, Southall, Middlesex (Southall 2411).

* * *

A synthetic-rubber plant, costing £500,000, is to be built at Fort Dunlop; work on the site has already begun. The plant will produce new synthetic rubbers on a sufficient scale for trial in tyres and other products.

* * *

Entitled *Hydraulic Efficiency*, a brochure lately issued by Fescol, Ltd., North Road, London, N.7, deals with their process of renewing the surfaces of rams used in presses and other industrial hydraulic equipment.

* * *

The Venner stand-by cabin lighting unit, which operates automatically in emergency on the power of a lightweight silver-zinc accumulator, is now available in an alternative flush-fitting design; it is quickly removable for use as a torch. (Venner, Ltd., New Malden, Surrey.)

* * *

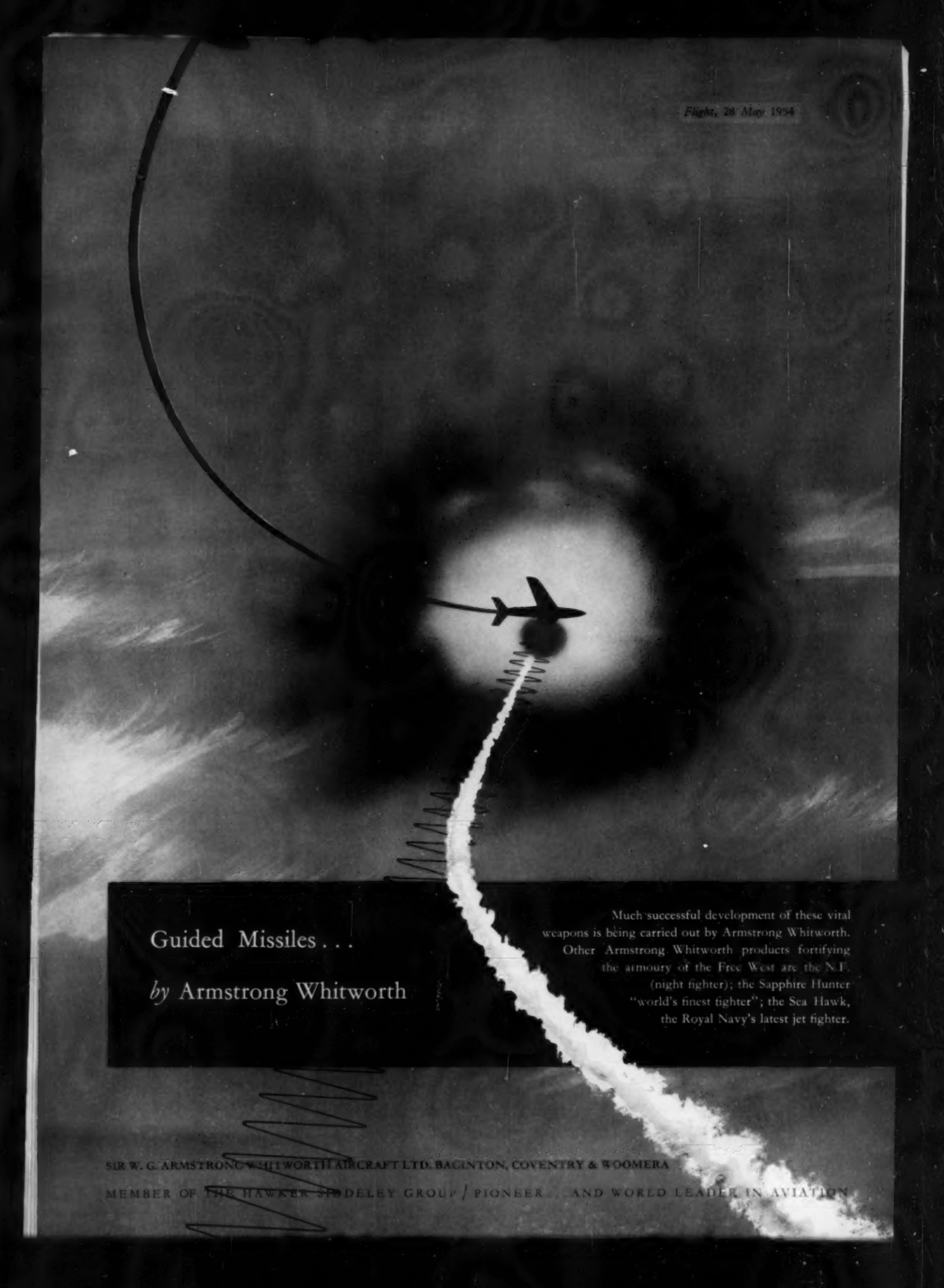
From the distributing agents, F. Kempner, 19 Ebury Street, London, S.W.1, come details of the new Primax balanced-grip soldering gun. A high-amperage current from a transformer in the handle brings the alloy tip (which needs no re-tinning) to working temperature in 6 sec, and trigger current-control is provided. Weight is 23 ozs.

* * *

Hedley S. Crabtree and Co., Ltd., consultant engineers, announce the appointment of Mr. J. Woodhouse, A.F.R.Ae.S., to their staff. In the mid-1930s he was with Imperial Airways, and in 1939 he joined the installation department of the Bristol Aeroplane Company's engine division. He later went to West African Airways Corporation, where he was appointed chief engineer.

* * *

A. K. Fans, Ltd., of 20 Upper Park Road, London, N.W.3, announce that, in connection with the increasing use of their products in the aircraft, electronic and other fields, Mr. W. H. L. Hewitt, of the G.E.C. Coventry works and Stanmore Laboratories, has joined them as technical director. This appointment marks the first of a number of changes in the company's organization. A technical services division has been established, to give advice on matters in all spheres of the firm's activities.



Guided Missiles . . .

by Armstrong Whitworth

Much successful development of these vital weapons is being carried out by Armstrong Whitworth. Other Armstrong Whitworth products fortifying the armoury of the Free West are the N.F. (night fighter); the Sapphire Hunter "world's finest fighter"; the Sea Hawk, the Royal Navy's latest jet fighter.

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD. BAGINTON, COVENTRY & WOOMERA

MEMBER OF THE HAWKER SIDDELEY GROUP / PIONEER . . . AND WORLD LEADER IN AVIATION

LOOK AHEAD WITH B.O.A.C.

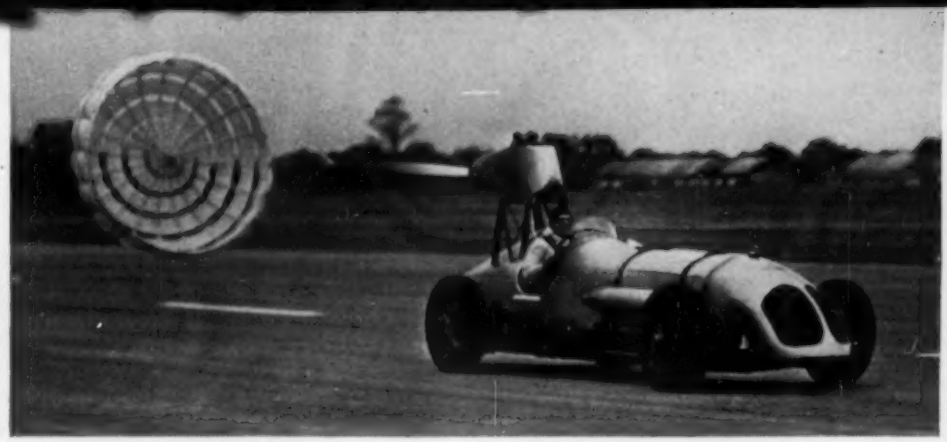
B.O.A.C. official photograph

Redifon Electronic Flight Simulators have now been well proven at the hands of British Overseas Airways' Central Training Unit, with the result that the design and construction of another Flight Simulator—this time for the Bristol Britannia—is now well advanced under contract with the Corporation. By this means the present high standards of proficiency and safety will be maintained by the crews of the Britannia fleet.

Redifon

FLIGHT SIMULATORS

REDIFON LIMITED, KELVIN WAY, CRAWLEY, SUSSEX. *A Manufacturing Company in the Rediffusion group.*



The multi-ring canopy, released at 135 m.p.h., is fully developed, though the full length of the strop is not yet extended from its housing over the tail of the Napier-Railton.

"Flight" photographs

GOOD PULL-UP FOR AIRMEN

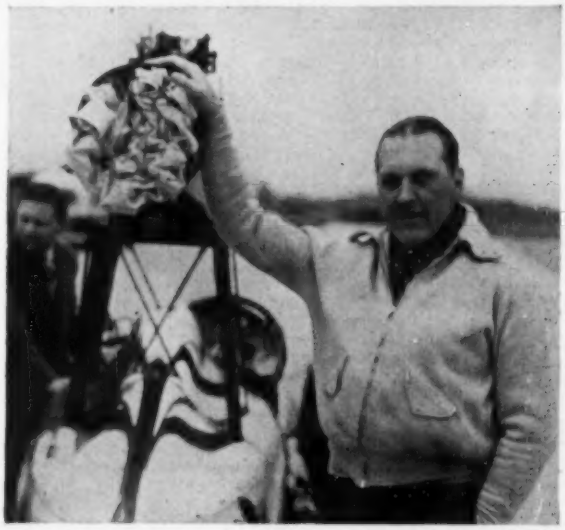
G.Q. Retractable Braking Parachute Tested and Demonstrated on a Famous Racing Car

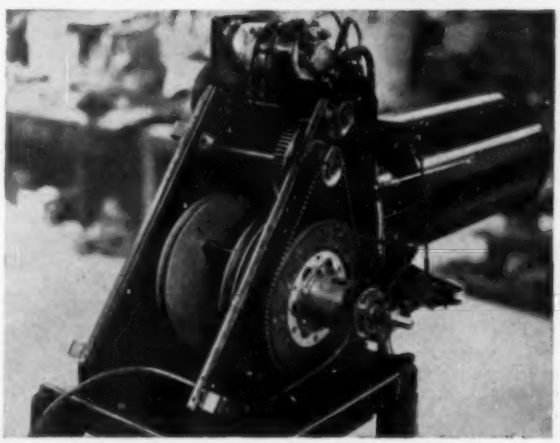
DUNSFOLD AERODROME, eight miles from Guildford, is well known as the centre of Hawker flight-testing, but in recent months it has also been associated with intriguing rumours of a new development in parachutes. Reports spoke of a massive and powerful car, driven at high speed along the runway by a certain baronet, and of tests with an unconventional method of braking.

The full story was told on Thursday of last week, when the G.Q. Parachute Company demonstrated the world's first *retractable* braking parachute. Two parachutes were shown: a 7ft-diameter "geometric porosity" canopy and an 8ft-diameter canopy with a single slot. The latter relies primarily on the porosity of the canopy material to absorb the energy of deceleration, whereas the 7ft canopy "breathes" through a series of concentric slots (this system gives greatly improved stability when porosity is reduced by moisture).

The test vehicle—driven by Sir Raymond Quilter, G.Q.'s chairman and managing director—is the renowned Napier-Railton racing car which, in the hands of the late John Cobb, its former owner, covered 100 miles at 168.59 m.p.h. at Bonneville in 1936. This was one of the 47 records held by the car (the first was in 1933), which was built by Thompson and Taylor of Brooklands and is still maintained by that firm—needless to say, in perfect condition.

Motoring enthusiasts with a special affection for this fine vehicle will note with satisfaction that it is not only doing a useful job, but that comparatively few modifications have been required to fit it for its new rôle. The lines of the car were altered when it was used in the film *Pandora and the Flying Dutchman*. In addition, G.Q. have added the following equipment: parachute with housing and operating mechanism; Dunlop disc brakes (rear wheels only) with Mintex liners; accelerometer; and ciné-camera





Above, Sir Raymond Quilter is seen with the retracted G.Q. parachute. On the right is the mechanism within the housing, showing the motor, reduction gear, winch and free-wheeling clutch. Below, the final and remarkable operation of retraction, here being performed at a speed of about 50 m.p.h.

"Flight" photograph

GOOD PULL-UP FOR AIRMEN . . .

recorder with lighting equipment. Powered by a 450 h.p. Napier Lion water-cooled engine, the car is in present form capable of about 145 m.p.h., which is sufficient for the experiments now being made. With larger tyres it could attain 175 m.p.h. Its performance, coupled with a weight of 4,500 lb, makes it the perfect test vehicle, capable of simulating the landing run of a typical high-performance aircraft on a 1,200-yd runway far more frequently and economically than could a flying vehicle.

The story leading up to the Dunsfold tests began early in 1951, when G.Q. began work on a scheme to dispense with the necessity for jettisoning a braking parachute at the end of the landing run. A stowage system was first devised by which the canopy could be automatically repacked ready for the next operation.

In July of that year a specification was issued for a parachute which would stow itself automatically when the aircraft speed had dropped to a predetermined value. The system was to be capable of repeated operation without attention, and without causing any damage to the canopy serious enough to affect its retarding performance.

A revised specification issued shortly afterwards stipulated that the elapsed time between the operation of the pilot's control and deployment of the canopy should not exceed 3 sec, and should be consistent within plus or minus 0.5 sec. Further requirements were that the parachute should be stable when deployed, and the installation suitable for landing in cross-winds of up to 20 kt, under which conditions it should be possible to perform retraction. After streaming, the canopy was to remain deployed until the aircraft speed had fallen to 30 kt, when it would retract automatically. This operation was to be completed in about 15 sec.

G.Q. decided that the parachute should be stowed in a telescopic cylinder, the outer (rear) part of the cylinder being arranged to slide forward over the inner, at the same time as the canopy was ejected rearwards by a piston energized by a large coil spring. The consequent shortening of the stowage space, coupled with the movement of the piston, would result in the canopy being exposed to the air—without "wadding"—in the least possible time. This, in fact, is the arrangement now under development test at Dunsfold.

The telescopic cylinder is designed to accommodate either a cluster of three 4ft-diameter canopies, as well as the 7ft and 8ft canopies fitted for the demonstration.

A winch-drum (operated through reduction gearing by a 2 h.p. Rotax C2801 electric motor, drawing its current supply—for purposes of the tests—from two 24V batteries in parallel) is mounted at the forward end of the stowage tube. To this drum is attached a webbing strop connected to the canopy rigging lines.

To retract the parachute, it is only necessary to switch on the winch motor, either automatically or manually. The strop and lines are then wound on to the drum and, when this action is complete, the telescopic cylinder automatically extends, shrouding and stowing the canopy.

Sir Raymond Quilter's demonstration at Dunsfold last week took the form of a series of fast runs at speeds of between 90 and 135 m.p.h.; the parachute was released on each occasion at top speed, deploying rapidly and producing marked deceleration. The drag of the 7ft canopy is sufficient to reduce the speed of the car from 135 m.p.h. to approximately 50 m.p.h. in 10 sec. There was no tendency, as might have been expected, for the front wheels to lift.

"Flight" photograph

The telescopic tube extended to house the canopy.

The retraction process—which is, of course, the novel part of the system—appeared equally effective. The canopy was returned to its telescopic container inside 7 sec at 50 m.p.h. A single switch, incidentally, controls both release and retraction of the canopy.

Addition of the powerful Dunlop disc brakes to the Napier-Railton is a precaution dictated by the possibility of parachute failure during the experimental stage. It may be added that Mintex, suppliers of the brake linings, have enacted the perfect *quid pro quo* by equipping their own test vehicle (an XK 120C Jaguar) with a G.Q. parachute as an emergency brake.

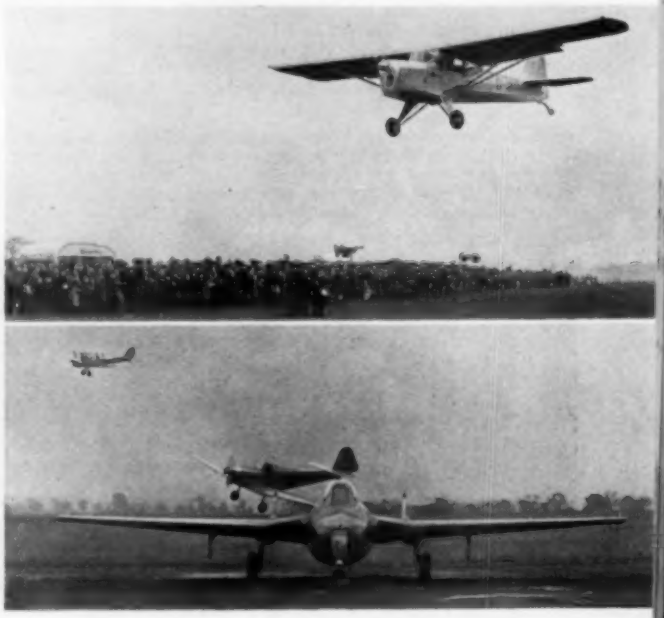
While there are several potential uses, both military and civil, for the retractable parachute brake, its most immediate application will probably be on fighters. It promises to make possible the use of shorter runways and to increase by as much as 700 per cent the life of conventional wheel brakes; with a parachute to provide initial deceleration at touch-down, the brakes need not be used above 80 m.p.h.

A typical single-engined fighter might need a canopy of some 10ft diameter, the complete installation weighing perhaps 50 lb; a jet bomber would probably use an assembly of three canopies, each of about 10-15ft diameter—the exact dimensions depending, of course, on the amount of drag required. In producing a workable retracting parachute G.Q. have successfully completed the first stage of an important project. The second will be to evolve installations capable of incorporation on existing aircraft; this is by no means a simple task, and the parachute designers' work will be greatly simplified when prototypes have built-in provision for this effective method of braking.

LEICESTER DEFIES THE WEATHER

DESPITE Saturday's damp, gloomy and chilly weather, Leicestershire Aero Club succeeded in staging all but two of the dozen-odd events in the programme of its display at Leicester East Airfield. The local R.Aux.A.F. squadron, No. 504, displayed its Meteor 8s, Jack Rice demonstrated an Olympia sailplane, finishing with a neat touch-down immediately in front of the public enclosure, and Ranald Porteus delighted the large crowd by doing the almost impossible with an Aiglet Trainer. The Royal Navy's contribution was some effective formation flying by Furies of No. 1833 Sqn. and Fireflies of No. 1844, plus Fury aerobatics by Lt-Cdr. Jenkins. F/L. Skullett, from R.A.F. Station Honiley, demonstrated that though (to quote the programme) "the Vampire is not considered a first-line fighter by modern standards, it is a very useful machine."

The parachute descent is a *sine qua non* at air displays, and on this occasion the performer—from a Tiger Moth—was A. J. Harrison. A commentary from aloft, by loud-hailers on an Auster, also pleased the crowd, as did the lively performance of three visiting ultra-lights, A. C. Waterhouse's 1935 B.A.C. Drone (also flown by Alfred Hughes), the Popular Flying Association's Dart Kitten (also flown by Mr. Waterhouse, and later by Oscar Maidment) and the Fairey Junior (Geoffrey Allington). We hope to publish further photographs next week.



In the upper picture Ranald Porteus is entertaining the crowd with the Aiglet Trainer; below, the Dart Kitten hides behind a Vampire FB.5.

CIVIL AVIATION

AQUILA TO CAPRI

ON Friday last an Aquila Airways flying-boat—Solent G-ANAJ *City of Funchal*—made a proving flight over the company's new Southampton-Capri route. Forty passengers were given a foretaste of the luxurious service, to be inaugurated on June 3rd, which provides the Mediterranean island with its first-ever air link. The Solent flew direct to Capri, completing the 1,200-mile journey in six hours. Scheduled services will call at Marseilles (where Aquila have full traffic rights) for a luncheon-break, as on Sunday's return flight. Fares for the service are £66 12s return (Southampton-Capri), £30 12s return (Southampton-Marseilles). There will be two round trips monthly in June, August and September, and weekly return flights during July. We hope to describe the proving flight in next week's issue.

"Flight" photograph

GOODBYE to the Isle of Capri; a final glimpse of the Mediterranean holiday resort as Aquila Solent "City of Funchal" turns on course for Marseilles and Southampton. Scheduled services to Capri will being on June 3rd, in tially on a fortnightly frequency.

DOUGLAS DEVELOPMENTS

INITIAL flight-testing of the Douglas DC-7B, which is the "over-water" version of the DC-7, has now been in progress for some weeks and final C.A.A. certification trials will begin in September. Douglas state that the most significant design change is the incorporation of a new flap-linkage system providing greater lift and reduced drag. In addition to an improved take-off and climb performance, the DC-7B carries additional fuel in "saddle" tanks located on the upper wing surfaces as part of the engine nacelles. Normal fuel capacity has been increased from 5,512 (U.S.) gallons to 6,400 gallons, and an additional 90 gallons can be carried in the centre-wing trailing edge tanks.

Its makers claim that the improved DC-7 will be the first airliner capable of regular non-stop service from London to New York against winter head-winds. The engines are DA.4 versions of the Wright Turbo-Compound, each delivering 100 h.p. more (M.E.T.O.) than the DA.2s fitted in the existing DC-7. Passenger capacity of the DC-7B will range from 40 seats in the "de luxe siesta" version to 95 tourist seats. Pan American have ordered a fleet of seven, at a total cost of about £5m, for transatlantic service next year.

There are now 35 DC-7s in service with four different airlines. It is reported that examples delivered to date have averaged 1,500 to 1,800 lb below the empty weight guaranteed by specification.

Another Douglas news item concerns the DC-6A Liftmaster. Although designed as a freighter, the aircraft can be adapted to carry passengers (as in the New Zealand race, when one of K.L.M.'s two DC-6As flew 76 people from London to New Zealand to win first place in the handicap section). The maximum seating capacity authorized by the C.A.A. has been increased from 88 to 105. The Flying Tiger Line, which has just taken delivery of a new DC-6A, employs "Burns Aero" lightweight seats which enable the aircraft to be converted from a freighter to a 105-seater in three hours.

THE AMERICAN VIEWPOINT

ENTITLED *Where do we Fly from Here*, a paper presented to the Society of Automotive Engineers earlier this month by Mr. William Littlewood, a vice-president of American Airlines, comprised an excellent "plain man's guide" to some of the major problems facing airline operators today.

Discussing the subject of medium-range airliners, the speaker hinted that the Viscount may see service on American domestic routes. He said: "Whether such an airplane should be built around two power plants of large size or four smaller ones is subject to debate and study. . . . It seems inevitable that within the near future we on the North American continent—and even here in the United States—will be faced with direct competition in this category from some four engine aircraft of reputedly smooth operating characteristics with high passenger appeal. The airplane in question is apparently excellent in many respects but does not appear to be as satisfactory as might be built with the availability of slightly larger power plants, and the modification of some design characteristics. Subject to the availability of suitable power plants, I think we must give most serious thought to the probability that our next American transport in this general category will be benefited by being of four engine type."

Mr. Littlewood's analysis of the long-range situation, from an American operator's point of view, was as follows: "There seems to be pretty general agreement that by about 1965, in long range, domestic and international transport we should expect to cruise close to 600 miles per hour. This is entirely consistent with the past rates of development and appears quite possible with known techniques. It is not quite so apparent exactly what propulsion devices we will use to achieve such speeds, but if we are to accept the assurances of the respective enthusiasts it can easily be done with jets; it can reasonably be done with by-pass type engines; or it can possibly be done with the use of turboprops. To the jet enthusiasts, with already noted accomplishments far into supersonic performances, it is largely a question of economics and noise. The thrusts can readily be developed, but the fuel consumption will be high and the noise, apparently, will be great. The by-pass enthusiasts, of course, stress the considerably better fuel consumption, the improved low speed thrust available for good close-in performances, the highly desirable somewhat decreased noise level at equivalent thrusts, and minimize the comparative size and weight factors, the problems of accessibility, and most important of all, neglect the fact that such a power plant is not yet available in the current American planning! The turboprop enthusiasts stress the equally good, or perhaps better, fuel consumption, the substantial flexibility and low speed thrust characteristics, the proven reversing advantages, the low noise level possibilities, but de-emphasize the high weight penalties required for such desirable noise characteristics, and the complex and serious problems of propeller control and operation, particularly under conditions of power failure.

"It is perhaps not my duty to accept or reject any of these positions—maybe you engineers can work them out to a most desirable conclusion—but I can't help expressing a great regret that there are not, in this country, under intensive development, more suitable types of engines to power possible future transport and long range military aircraft. Neglect of such possibilities points up a serious deficiency in our national aviation technical development programme since the war. Indeed, we, in America, have had no such national aviation development programme as our British cousins have had. The results have been disappointing and discouraging in this area of vaunted American superiority."

S.L.A.E. MEETING

AT the annual general meeting of the Society of Licensed Aircraft Engineers, held in London on Saturday last, Mr. A. C. Jack, engineer-in-charge of Avro's technical department, was installed as president. He takes over from Mr. N. H. H. Luke. The Society's premier annual award, the Gold Badge, was awarded to Mr. T. C. E. Tringham, chief inspector of Aquila Airways, for a paper on corrosion published in the October 1953 issue of the S.L.A.E. *Journal*.

The Dorothy Spicer Memorial Prize for 1954 was awarded to Mr. W. T. Truscott, an instructor with A.S.T. at Hamble, for a paper on high-speed aerodynamics. The annual address to the Society was delivered by Mr. M. H. Curtiss, vice-chairman of the British Independent Air Transport Association and managing director of Hunting-Clan Air Transport.

CIVIL AVIATION...

TAKING SHAPE: This recent view of the central area of London Airport, taken looking northward from a B.E.A. Bell 47 helicopter, shows how the control block and traffic terminal building are progressing.

HOT NEWS

SUSPENSION of newspaper deliveries from London to the west country, which might otherwise have followed last week's Western Region rail dispute, was avoided by the swift action of B.E.A. on the day the trouble started. In co-operation with three independent companies, Eagle Aviation, Transair and Hunting, the Corporation delivered some 45 tons of papers to Cardiff and Exeter in the early hours of Wednesday, May 19th. Deliveries on a similar scale were continued on the Thursday and Friday.

The B.E.A. aircraft, which were three Pionairs and six Admiral-class Vikings, left Northolt in quick succession, and arrived at Cardiff and Exeter Airports after flights of 1 hr 10 min.

CENTRAL AFRICAN RESULTS

A PRELIMINARY report issued by Central African Airways on the financial year ended March 31st, shows that during that period they carried over 115,000 passengers, as against 98,165 in the previous year; total passenger-miles flown being 58,986,521 or 27 per cent more than in 1952-53. Freight traffic also increased—by over 80,000 ton-miles to 599,218, which was 15 per cent higher than in 1952-53.

Commenting on the results, a C.A.A. spokesman said that it would be remembered that during April, May and June the Viking fleet was withdrawn from service to undergo main-spar repairs. During the year the cheap-fare Zambezi service increased in popularity; without it "the traffic figures would not present anything like such a good picture."

C.A.A. have also announced the introduction of new South African Airways timetables to provide Rhodesians who travel on the C.A.A. service to Johannesburg with direct, same-day connections to and from Capetown. Same-day connections to Northern Rhodesia are made possible by the new C.A.A. night flights to Lusaka and Ndola, on two evenings a week. It will now be possible for a passenger to accomplish the 1,800-mile journey from Ndola to Capetown in 12 hours, and from Salisbury (1,400 miles) the time will be only 8½ hours.

OUTMODED (not that it was ever fashionable) by the new L.A.P. buildings is the miscellaneous line of hutments straggling alongside the Bath Road. In the foreground can be seen the traffic roundabout and the entrance to the tunnel which will give access to the central area.

CENTAURUS OVERHAUL-LIFE INCREASED

AS briefly mentioned in our special "Power Units of the World" issue of April 9th, the approved overhaul-life of the Bristol Centaurus 661 fitted to B.E.A.'s Elizabethan aircraft has recently been increased from 800 to 1,000 hours. A further increase to 1,200 hours in the near future is hoped for.

The operational record of the Centaurus with B.E.A. is impressive. The first Elizabethan was delivered to B.E.A. in September 1951, the Centaurus engines beginning their civil career with the conservative life of 300 hours (subsequently raised to 600, 700 and finally 800 hours). After eighteen months' service, 40,250 engine flying hours had been completed and the average life achieved was 480 hours per engine. During 1953 this average increased to 585 hours and, over the first three months of 1954, to 835 hours. Engine flying hours since the start of operations now total over 80,000, and 91 per cent of permissible life has been achieved.

BREVITIES

NORTHOLT will be closed to civil flying after October 31st, 1954, and from that date it will no longer be available for civil aircraft either as a regular terminal or as an alternative airport. This was announced by the Minister of Transport and Civil Aviation on May 12th, in reply to a Parliamentary question.

* * *

For the past two years traffic controller (developments) for B.O.A.C., Mr. D. O. Bustard has recently been promoted to the position of traffic manager.

* * *

News of an unofficial record set up by a S.A.S. DC-6B for the westbound transatlantic crossing has just come from Scandinavia. The aircraft, *Vidar Viking*, flew the 3,207 miles from Prestwick to New York on May 1st in 11 hr 7 min, arriving four hours ahead of schedule.

* * *

The first of five Super Constellations ordered by Air India International called at London Airport on May 14th *en route* for Bombay. The aircraft, named *Empress Nurjehan*, was flown from Burbank by an Indian crew. On June 8th it is scheduled to inaugurate the company's latest service from Bombay to London.

* * *

B.O.A.C. announce that their engine repair factories at Treforest have won a U.S.A.F. contract worth $250,000 (£90,000) for the overhaul of Pratt and Whitney engines. The Corporation states that the contract was open to tender and was won in the face of keen competition from Continental overhaul organizations and other concerns.

* * *

The award of two $2,000 fellowships at Columbia University, providing for original research on a graduate level into potential markets for the company's transatlantic freight services, are announced by Seaboard and Western Airlines. The recipients are W. A. Jordon, a former cargo sales representative for Air France in New York City, and E. B. Gasser of the University of Zurich. Two similar fellowships were awarded last year.

* * *

An additional weekly tourist service from New York to Manchester was introduced by Sabena on May 18th; subject to Government approval, an extra weekly flight in the reverse direction will be offered from June 14th. Sabena first operated a weekly round-trip tourist service between Manchester and New York on October 28th last year and a weekly first-class service was added in December.

CLUB AND GLIDING NEWS

FORMATION of a flying club in the Huntingdon area is at present being discussed by a group of local enthusiasts. Brampton racecourse, near St. Ives, has been suggested as a flying base (it has two runs, each of at least 1,000 yards, and appears fit for early use); two ex-R.A.F. Tiger Moths will probably be acquired in the near future if all goes well. Interested readers—and particularly any suitably licensed ground engineer and flying instructor—are invited to contact S/L. J. Mills, at The Shooting Box, Broadway, St. Ives, Hunts.

EIGHT first solos, three P.P.L.s and 329 flying hours were achieved by the Elstree Flying Club during April. Night flying, however, was curtailed by bad weather, conditions being suitable on only one of the scheduled weekly occasions. On Saturday, June 12th, the club is holding an "At Home" and flying display, starting in the late afternoon, to which visiting club members are invited (but not, it is regretted, the general public). A varied programme of competitions and demonstrations will be followed by a party in the evening.

DENHAM Flying Club members logged 254 hours during April. "Four A.T.C. cadets," the club reports, "were hounded, driven, coached and flown until two obtained their P.P.L.s, and the third and fourth are now on the point of completion. Philip Spensley and John Axtel made first solo flights. A breakfast patrol, to be held at Denham on Sunday, June 13th, between 9 and 9.30 a.m., has been announced.

ANOTHER club occasion in June is the "At Home" of the Fair Oaks Aero Club on Sunday, the 27th. The flying display is to begin at 2.30 p.m. A recent P.P.L. was that obtained by Peter Johnston, son of "Johnny" Johnston, one of the club's private owners. April's good flying weather was again reflected in a record number of hours—324.

YET another "At Home" is that of the Yorkshire Aeroplane Club at Sherburn-in-Elmet on Sunday, July 18th. April flying hours amounted to 181½, and first solos were made by John Burrows and A.T.C. cadets Froggatt and Hough. Response from club members to the A.T.C. air experience scheme is now so great that Y.A.C. is beginning to run short of cadets, although, the club states "we are expecting a new bunch any moment now."

DURING April, the Cambridge Aero Club completed a total of 300 hours' flying. Seven members made their first solo flights and of these six went on to qualify for their Private Pilot's Licences. In addition to the basic training, two members carried out night flying to qualify for their commercial licences, and another completed a ten-hour refresher course required for his senior commercial licence.

COMMITTEE members of the newly-formed Surrey Flying Club (successor to the Redhill Flying Club) are: C. Nepean Bishop (chairman), A. Sproxton (C.F.I.), P. Chinn, K. Freeman, D. E. Miller, G. S. Oldershaw, A. Gilbert, G. Lefaerty, A. Crouch, P. G. Rumsey, and Miss D. Pitman. Joint honorary secretaries are Miss Hilda Smithers and Miss Mary Briggs. The club is now operating from Croydon Airport, and its telephone number is Croydon 7744.

FROM the Cardiff Aeroplane Club we regret to learn of the death of Mr. G. Watkiss, their chief engineer, whose association with aviation went back to the days of the man-lifting kites in Bill Cody's "Wild-west" show before the first world war. After becoming an aircraft ground engineer, Mr. Watkiss worked in airships in the R.N.A.S. during World War 1, and later returned to aircraft as ground engineer to Capt. "Bill" Bailey, R.N., at Newport, Mon. He also held a pilot's licence and sometimes did joy-ride flying. On the formation of the Cardiff Aeroplane Club in 1931 (when Pengam Farm became Pengam Moors Airport), "Wattie" became the club's chief engineer. His service in World War 2 was as a civilian engineer working with the Royal Air Force, and he returned to the club when it renewed its activities in 1947.

ANAVIGATION and reliability trial for light aircraft, organized by the R.Ae.C. of New South Wales, and sponsored by Redex Products, is to take place in Australia from August 5th to 14th. The distance covered will be over 7,000 miles, and the course (starting and finishing at Sydney) will pass over much sparsely settled and poorly mapped outback country. The object of the trial is to encourage and demonstrate the reliability of light aircraft in Australia, and the first prize is of £1,000 and the Redex Trophy. Competing aircraft are limited to a weight of 12,500 lb.

CHIPMUNKS from R.A.F. station, Middle Wallop, escorted a group of 20 club aircraft from Eastleigh to Jersey on May 15th on the occasion of the Channel Islands International Air Rally. At the rally, a *concours d'elegance* prize was awarded to the Nighthawk belonging to G/C. C. M. M. Grece, who is station commander at Middle Wallop.

GOOD progress has been made by the recently formed Taunton Vale Gliding Club. At a meeting of members, Mr. B. Masters (chairman) said that permission had been granted to use a section of Sampford Common, on the west ridge of the Blackdown Hills. The club has two single-seaters, but still requires a two-seater, a winch and a retrieving car. Application has been made to the Kemsley Flying Trust for a loan of £1,000.

AT Lasham, Derek Piggott has taken up duties as full-time C.F.I. It may be remembered that F/L. Piggott was awarded the 1953 de Havilland and Seager Cups for his climb of 15,240ft in a T.21B Sedbergh during last year's Nationals. Flight tests of the K.1 and the T.41 Skylark 2 (by Hugh Kendall and Philip Wills, and the B.G.A. No. 1 Test Group respectively) are continuing. Club flying by members of the Surrey/Imperial College/Army group accounts for most of the 3,500 launches made this year up to the end of April; 20 first solos were made during the same period.

NOW available to members and associate members of the Royal Aero Club through the Air Touring Department is a new-type R.A.F. navigational computor, the Mk 4. The principle of operation is the same as that of the well known Dalton computor, but the new type is only ¼in thick, having a stiff plastic strip instead of the former linen band and rollers. The speed scale extends from 80 m.p.h. to 800 m.p.h., the two sides of the plastic strip being graduated for the low and high speed ranges respectively. Overall size of the computor is 11in × 5in × ¼in, and the price is £3 10s 0d, plus 9d for packing and postage.

ALSO obtainable from the Air Touring Department at Londonderry House is this year's edition of the *Air Touring Guide to Europe*, price 7s 6d, plus 6d postage. This book remains, for any private pilot contemplating a continental flight, as near essential as makes no difference. In it the otherwise formidable requirements of pre-flight planning are explained, and details are given of the facilities and position of all the major European aerodromes suitable for "air tourist" use. Other useful features include maps of suggested routes; lists of U.K. flying clubs and met offices, and European landing and hangarage fees; a brief eight-language vocabulary; and a number of conversion tables. The Air Touring Guide will doubtless continue to be carried this season, as in previous seasons, in the flight document bag of the majority of continent-bound club and private pilots.

DESTINATION JERSEY: A final briefing by Mr. R. Langridge (Hampshire Aeroplane Club) before the take-off from Southampton (Eastleigh) Airport of aircraft from several clubs—escorted by R.A.F. Chipmunks—for the Channel Islands International Air Rally at Jersey on May 15th.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

FAMILY PARADE: One example each of all the Canberra types in production at the English Electric Company's works at Preston, Lancashire. Seen receding from the foreground are marks P.R.7, B.6, T.4, P.R.3 and B.2.

No. 501 Squadron Jubilee

TO celebrate its 25th anniversary on June 19th, No. 501 (County of Gloucester) Squadron, R.Aux.A.F., will fly in formation over several Gloucestershire towns. The Squadron was first formed in 1929, and was equipped with Hurricanes when it went to France in 1939; it was thereafter stationed in the U.K., taking part in the Battle of Britain, in offensive sweeps over France and in the defence against the V-1. Against the latter it operated in night fighters and shot down over 100 flying bombs. The honorary air commodore is H.R.H. the Duke of Gloucester.

Sawdust and Gunpowder

THE R.A.F. contribution to the Royal Tournament at Olympia this year will consist of a demonstration of aircraft safety equipment. Though the term may sound pacific enough, the demonstration is spectacular, culminating as it does in the firing of a fully loaded ejection seat from the cockpit of a Meteor into a net.

The demonstration—which we recently saw in rehearsal—is opened by four teams of trainees, who carry out closely co-ordinated parachute landing falls from ramps and from bomb trolleys towed by tractors. This is followed by a demonstration of ejection technique carried out on the Martin-Baker mobile ejector seat test rig. The tower is raised and an airman is shot up it by a single ejection charge. As the rig's tower is again lowered on to its Queen Mary trailer and removed from the arena, a complete Meteor 8 is towed in by a tractor and positioned below a large net suspended 48ft above the ground. At a given command, the hood slides back and dummy and seat, weighing some 300 lb, are ejected with the full charges. Seat and dummy describe a graceful arc and land in the net. Immediately after this, a parachutist wearing the latest crash helmet, Mae West and aircrew boots descends from the roof by his parachute. An airman then climbs into the still-smoking cockpit and taxies the Meteor away with the aid of electric motors mounted on the mainwheel forks. A Vampire main wheel has been adapted as a braking nosewheel.

This part of the tournament has been excellently produced by F/O. S. Haig-Brown under the command of S/L. J. Onions, D.F.M. About 70 men from all U.K. commands have now been training for this event at R.A.F. Cardington for some weeks. The team was due to move to London today.

No. 5 Squadron's Standard

A FORMER member of the unit, Air Chief Marshal Sir Leslie N. Hollinghurst, was the reviewing officer at the recent presentation of a Sovereign's Standard to No. 5 Squadron at Wunstorf, Germany.

In his address after presenting the Standard, Sir Leslie complimented the squadron on the excellence of the parade and the high standard of drill. He also recalled with pride his early days in India, in 1921, when he served with No. 5, and he remembered that the unit could be relied upon to win any trophies open for competition.

The eight battle honours selected for inclusion in the Standard are: Mons - Ypres 1915 - Loos - Arras - Somme 1918 - Amiens - Arakan 1942-44 - Burma 1944-45.

Commanded by S/L. P. V. Ayerst, D.F.C., No. 5 Squadron is the second unit of the R.A.F. to be equipped with the D.H. Venom F.B.1. It was first formed at Farnborough in July 1913 and went to France with the Expeditionary Force in 1914. It claims to have won the first air victory credited to the Royal Flying Corps, when an unarmed Avro 504 forced a German aircraft to land. The squadron's association with the Canadian Corps is the reason for the maple-leaf motif which appears in the badge.

After the 1914-18 war the unit was disbanded and re-formed again in India in 1920, where it remained and was largely concerned with army co-operation on the North-west Frontier.

In 1942 it was based at Calcutta and equipped with Curtiss Mohawks, which were used for bomber escort duties over the Chindwin valley. Later the squadron's rôle changed to that requiring fighter-bomber aircraft; Hurricanes and, finally, Thunderbolts replaced the Mohawks. A second disbanding came in 1947 and the

WUNSTORF CEREMONY: As recorded above, Air Chief Marshal Sir Leslie N. Hollinghurst recently visited 2nd T.A.F. to present a Sovereign's Standard to No. 5 Squadron. He is seen below inspecting the unit and making the presentation.

unit was again re-formed at Wunstorf, as a fighter ground-attack squadron of 2nd T.A.F., in 1952.

R.A.F. Appointments

AMONG recent appointments announced by the Air Ministry are the following: G/C. C. E. J. Baines, C.B.E., to Cranwell as chairman of the selection board, G/C. D. M. Somerville to H.Q. Amphibious Warfare, G/C. K. A. Merritt to the Ministry of Supply and both G/C. O. M. Berkeley, O.B.E., and Act. W/C. B. B. Johnson, to the Department of the Air Member for Supply and Organization.

Appointments in command include those of G/C. W. A. J. Satchell, D.S.O., to Cardington and W/C. E. P. Wells, D.S.O., D.F.C., to Bawdsey. For air staff duties Act. G/C. J. B. Russell, D.S.O., has gone to H.Q. No. 19 Group and W/C. D. W. Edwards, D.F.C., A.F.C., to H.Q. No. 61 Group.

G/C. P. W. Stansfield is now at SHAPE, W/C. C. C. Howes at H.Q. A.A.F.N.E., and W/C. J. S. Laird, O.B.E., with the Home Fleet, all on staff duties.

Six administrative appointments are those of G/C. R. W. M. Clark, O.B.E., D.F.C., to H.Q. No. 41 Group, Act. G/C. G. P. S. Pollard, C.B.E., to H.Q. No. 63 Group, W/C. R. R. Jack to H.Q. Flying Training Command, W/C. P. N. Isaac to Warton, W/C. L. W. V. Jennens, O.B.E., to Wellesbourne Mountford and W/C. R. P. Norman to No. 107 M.U.

W/C. F. G. Toone has gone to Wyton, W/C. H. B. Hurley to H.Q. No. 21 Group and Act. W/C. W. H. Coast to R.A.F. Flying College, Manby, all for technical duties.

Award

THE *London Gazette* of May 11th announced that the Queen has been graciously pleased to approve the award of the British Empire Medal (Military) to Sen. Tech. R. Evans, of R.A.F. Station Luqa, Malta.

On December 16th, 1953, Evans was flying in a Valetta when it crashed and burst into flames near Qormi village. When the captain checked his crew on leaving the aircraft, the signaller was unaccounted for. Evans climbed on to the nose of the burning fuselage and broke his way in through the Perspex of the pilot's cockpit. Despite the fact that the aircraft was burning furiously and full of smoke, he remained in the fuselage looking for the signaller until he was ordered by the captain to leave. He was only just clear of the wreckage when the tanks exploded and the aircraft blew up.

In re-entering the burning aircraft to look for his fellow non-commissioned officer, Sen. Tech. Evans showed complete disregard for his own safety and, had it not been for the fact that the captain ordered him out of the aircraft, he would probably have remained to the end. Unknown to the captain and to Evans the signaller (who was severely burned) had escaped and had been taken away by some Maltese labourers.

SQUADRON LEADERS: The five commanding officers who led the squadrons taking part in the Fleet Air Arm fly-past on the return of the Queen to Britain. Left to right: Lt-Cdr. A. Gordon-Johnson (No. 890, Sea Venoms), Lt-Cdr. C. E. Price, A.F.C. (No. 813, Wyverns), Cdr. E. M. Brown, O.B.E., D.S.C., A.F.C., M.A. (No. 804, Sea Hawks), Lt-Cdr. D. M. Steer (No. 802, Sea Hawks) and Lt-Cdr. D. G. Parker, D.S.O., D.S.C., A.F.C. (No. 898, Sea Hawks).

D-Day Diorama

FOR exhibition in the Musée de Débarquement, Arromanches, Calvados, a diorama of the battle for the Normandy beaches has been constructed under the sponsorship of the Ministry of Supply. The work has been carried out by Mr. D. C. Stokes, who specializes in model-diorama construction; he was assisted by J. A. Greenwood and Miss K. Ball.

The scene is very live. On the 10ft by 5ft area are over 700 miniature figures, complete with weapons and equipment. Flails, bombards, flame-throwers, mortars are all displayed in their appropriate rôles and airborne troops are seen assaulting a defending coastal battery. The backcloth depicts the naval side of the attack, and above all are the aircraft of the Royal Air Force and Royal Navy.

Squadron Tie

PAST members of No. 145 Squadron will be interested to learn that a squadron tie has been designed and will shortly be available from the Adjutant, No. 145 Squadron, Royal Air Force, Celle, B.A.O.R. 23.

Polish Bomber Reunion

ON May 15th the Poles who served in R.A.F. Bomber Command held their fifth reunion. The day started with ceremonial Mass at the Brompton Oratory where, as is the annual custom, the squadron badges were displayed on the altar. Later a wreath was laid at the Polish Air Force Memorial at Northolt Airfield.

At a gathering in the afternoon at the headquarters of the Polish Air Force Association in London, speeches were made by Lt-Gen. Anders and A.Cdre. S. Karpinski and a message of greeting was sent to Marshal of the R.A.F. Sir John C. Slessor, who is patron of the association.

The evening was given over to a cocktail party and a ball.

Goldfish Club

THIS club, which was first formed in 1942 for allied aircrew who baled out over the sea or survived a ditching, is holding its annual reunion dinner this evening at Ye Olde Cock Tavern, 22, Fleet Street, London, E.C.4.

Principal guests at the dinner will be Marshal of the R.A.F. Lord Tedder—who survived a ditching in the Channel in 1923—Vice-Admiral Sir John A. S. Eccles, Flag Officer Air (Home) and Major-General F. D. Rome of the 16th Airborne Division.

Membership of the Club has now been extended to include members of the R.F.C., R.N.A.S. and R.A.F. who had appropriate experiences in the 1914-18 war or in the years between the wars.

Particulars may be obtained from the hon. treasurer, Mr. H. C. Friend, 76, Redesdale Gardens, Isleworth, Middx (Hounslow 9445).

MIDDLE EAST WINNERS: The team which has won the Middle East inter-Services rifle championship. The R.A.F. has beaten the other Services for three years in succession. Front row: Sen. Tech. V. T. Kidson, Sen. Tech. J. Witts, F/L. G. F. Stubbings, F/S. K. R. Baines and S.A/C. K. Wilson. Back row: F/S. G. Roach, Cpl. G. L. Dancer, F/O. P. T. Dudley and F/L. M. V. Black (reserve).

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

The B.E.2 Series

AS one who during the First War flew the B.E.2 in its varied forms—the 2E with its flimsy top-plane extension and the fully-braced 2C and 2D—and loved them well, in my turn I feel rather surprised to read in Mr. A. H. Curtis's letter that he evidently found such difficulty as he describes in manœuvring this excellent little 'plane.

I cannot recall any difficulty in making the B.E. do what I wanted, although as a fighter it was, by reputation, too sluggish. Nevertheless, I remember the joy with which I flew it round Sedgeford Aerodrome in Norfolk. I cannot say the same, however, for my experience later at Stonehenge, where we had some very distressing accidents. For some reason the pilots stationed there ran into a series of "flat spins" at low altitude, a phenomenon which began near the stall and generally ended with the conventional spin which more often than not ended fatally.

Nevertheless, I retain the pleasantest recollections of the B.E.; maybe this is because I graduated to it from the D.H.6 trainer which really *was* stable, not to say heavy, albeit an excellent trainer for the *ab initio* pilot.

Sanderstead, Surrey. W. ARMSTRONG.

Opportunities in Canada

IN fairness to the Canadian aircraft industry in general I am prompted to reply to the letter from "Disappointed" in your issue of April 2nd.

I emigrated from England in 1948 at my own expense and without a job in view; I was grateful therefore to find immediate employment in the aircraft industry. As I have since been employed by all three major Canadian aircraft organizations, I feel qualified to question the accuracy of "Disappointed's" letter.

During my six years in Canada I have never felt that my progress has been retarded because of my nationality and I have seen many senior positions filled by Englishmen. It is my opinion, therefore, that the prejudice inferred by "Disappointed" is not substantiated.

One hardly expects the Canadian way of life to follow the English pattern, and on this basis one should not emigrate unless prepared to accept the change. Regardless of "Disappointed's" dollars-to-pounds conversion factor the standard of living here is accepted to be higher than in England; and anyone offered a family paid passage and a contract of employment has an advantage shared by few other emigrants.

Montreal, P.Q. A. G. BLACKBURN.

No. 603 Sqn: Memories of a Commanding Officer

I WOULD like first to congratulate John Yoxall on his history of "The Queen's Squadron"—No. 603 (City of Edinburgh) Squadron. As official information available for such purposes is often far from complete, I would like to add some further details for the period during which 603 operated in the Western Desert in 1943-44.

The Cos and Leros operations are not mentioned as epics of the period when the Royal Air Force and its Regiment, the Royal Navy and a few gallant Commandos engaged in an abortive attempt to gain a foothold on the "entrance to the Balkans."

Early in September 1943, the Italians capitulated and Greek and Italian islands like Cos, Leros, Stampolia, Simi and Castel Rosso were soon occupied by our troops and squadrons. In the early hours of October 3rd, the Hun invaded Cos and the R.A.F. Beaufighter Squadrons operating from Cyprus and North Africa suffered heavy losses; even night fighter squadrons were employed on anti-shipping strikes in order to try to stem the sea invasion.

No. 603 Squadron, however, operated from El Adem and, so far as I can remember, were more concerned in the Leros operations with their neighbouring Torpedo Beaufighter Squadron No. 47.

About this period, also, large forces and loads of equipment were being massed for a possible second-front entry into the Balkans, and I remember 603 being warned that they were included in Force "X"; snow-shoes were then discovered in the pack-up!

As regards the occasion of our first sortie carrying rockets, I would like to add to Mr. Yoxall's comment by quoting an entry in my log-book as it may amuse any members of that formation who may now read it: "December 15th. Aegean Sweep. Led 8 Beaufighters, first 4 with rockets, 60 lb heads. Anti Kythera, Melos, Skrephos, Thermia and Kythera. No sightings, but saw 2 Me 109s patrolling Anti-Kythera to Crete. Broke formation to port, but could not close nearer than five miles. The 109s seemed disinterested and drew away. If Jerry knew that 64 rockets awaited, may have run faster. Turned and continued sweep."

During a combing of the Aegean in April, 1944, hundreds of barrels of oil were sighted on the shore of an island and were duly set ablaze. For months before, the Hun had been endeavouring to lay a landing strip for the intended use of 109s and transport aircraft. Beaufighter Squadrons daily watched and waited and, after the German "A.M.W.D." had made due progress, they would sail in and reduce their efforts to trouble and rubble. One day the joke was on us, for, during a sweep, I sighted umpteen barrels of something stacked neatly on the square of Naxos. Our rockets were released in the centre of this lovely harbour-front—but no black smoke appeared. Later, Intelligence informed us that the barrels had been full of citrus juices!

My final point which, I consider, may interest old members of 603 was the operation against eleven ships on the glorious June 1st (this, I think was the "fitting end" of my command of 603). Our A.O.C., A. Cdre. Allinson, received news of a large convoy being prepared at Piraeus. I was instructed to fly to Cyprus and investigate the possibilities of operating the strike wings from a Beaufighter O.T.U. It was finally decided to bring the Beaufighter Squadrons to Gambut and I received the dismal news of organizing the strike from the Wing's Operations Room. In consequence, Tony Maharg, O.C. 252 Sqn., led the force. The result was a 100 per cent success, as the crippled ships who managed to reach port were finally finished off by our bomber colleagues.

During the period for which I had the honour to serve in 603 Sqn., I recorded a score of approximately 16,000 tons of shipping destroyed or probably destroyed, eight enemy aircraft destroyed, two probables and nine damaged.

R.A.F. Station Finningley. J. R. H. LEWIS.
Wing Commander.

Auxiliary-Powered Sailplanes

I NOTICE that an error had crept into one of the captions to the glider drawings on page 609 of the May 14th issue of *Flight*. The C.10 was a product of the Flugtechnische Arbeitsgemeinschaft at Chemnitz. It is fully described in *Der Deutsche Sportfleiger*, 8. Jahrg., 162-163 (1941). Oddly enough, this source also describes a Nipponese powered glider, the Nippon H.K.K. "Hachi," but does not illustrate it (an illustration, however, appears in *Flugsport, XXXIII*, 172, 1941). Registration of the C.10 was D-YFAG.

Okehampton, Devon. DENNIS J. VOADEN.

FORTHCOMING EVENTS

May	29.	R.A.F.A. Cheltenham and Gloucester: Air Display, Staverton.
May	29.	Percival Aircraft, Ltd., and Field Aircraft Services, Ltd.: "At Home" to owners of Percival aircraft, Luton.
May	29.	Ragosine/Auster Homing Cup Competition, Rearsby, Leicester.
May	29-30.	Leghorn Aero Club: Air Tour of Tuscany.
May	29-30.	Aero Club of Fréjus-St. Raphaël: International rally of the wine of Provence.
May	30.	Aero-Club de France: Foire de Paris International air rally, Toussus-le-Noble Airport.
June	2.	Pescara Aero Club: International aerobatic contest.
June	5.	Swansea and District Flying School and Club: Welsh Air Derby.
June	5-6.	Niedersachen Section of Aero Club of Germany: International air rally, Hanover.
June	5-7.	Dauphiné Aero Club: International Rally.
June	6.	Modena Aero Club: International aerobatic contest, Modena.
June	7.	S.S.A.F.A.: Air display, Yeadon Aerodrome.
June	9-19.	Mechanical Handling Exhibition and Convention, Olympia.
June	11-13.	Royal Netherlands Aero Club: International air rally.
June	11-14.	Palermo Aero Club: Sixth International air tour of Sicily.
June	12.	Elstree Flying Club: "At Home."
June	13.	Tangier Aero Club: Rally.
June	13.	R.Ae.S. Garden Party, London Airport.
June	13-27.	Polish Aero Club: International gliding competitions.
June	18-19.	R.Ae.C.: National Air Races, Coventry Civic Aerodrome.
June	19-20.	Eighth air rally of the wines and chateaux of Anjou.
June	19-21.	Aero Club of Savoie: Vermouth international rally, Chambéry, Savoie.
June	20.	Northamptonshire Aero Club: "At Home."
June	21-24.	Institute of the Aeronautical Sciences: Annual summer meeting, Los Angeles.
June	24-25.	Women's air rally, Deauville.
June	26.	Plymouth Air Display Committee: Air display.
June	26-27.	Aero-Club de Fleurs de l'Orne: Normandie Rally.
June	27.	Aero Clubs of France and Marseilles: International speed contest, Marseilles.
June	29.	Milan Aero Club: Milan Grand Prix.
July	3.	R.N.A.S. Eglinton: Air Day.
July	3.	R.N.A.S. Bramcote: Air Day.
July	3-5.	R.Ae.C. members' Deauville Rally.

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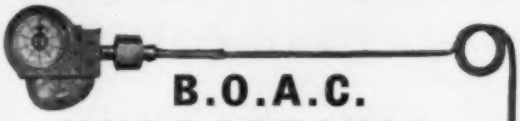

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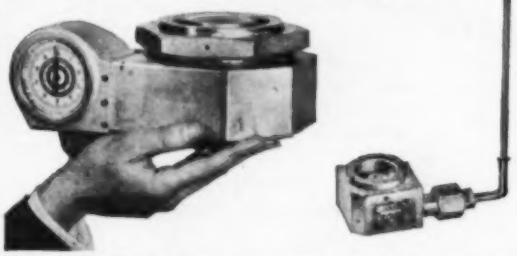

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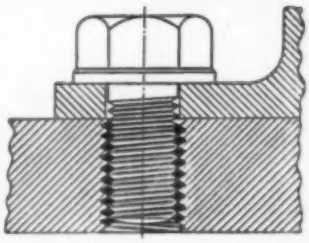

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM Dragon Airways, Ltd., of Speke Airport, Liverpool 19.

APPLICATION No. 299 for a seasonal U.K. internal service, initially with D.H.89, Gemini and Auster aircraft and later possibly with Prestwick Twin Pioneer aircraft, for the carriage of passengers, supplementary freight and mail between Liverpool (Speke) and Pwllheli (Broomhall) at a frequency of from two to seven services weekly according to demand during the season from May 1st to September 30th inclusive for a seven-year period commencing June 5th, 1954.

APPLICATION No. 300 for a seasonal U.K. internal service, initially with D.H.89, Gemini and Auster aircraft and later possibly with Prestwick Twin Pioneer aircraft, for the carriage of passengers, supplementary freight and mail between Manchester (Ringway) and Pwllheli (Broomhall), with an intermediate on demand traffic stop at Liverpool (Speke), at a frequency of from one to four services weekly according to demand, during the season from May 1st to September 30th inclusive for a seven-year period commencing June 5th, 1954.

APPLICATION No. 77/3 from Eagle Aviation Ltd., of 29 Clarges Street, London, W.1, for permission to include optional traffic stops at Strasbourg and Graz and at Linz as a possible winter alternative on their normal scheduled service between London (Blackbushe) and Belgrade (Application No. 77) which has been approved by the Minister of Transport and Civil Aviation for operation until March 31st, 1960.

APPLICATION No. 301 from Silver City Airways, Ltd., of 1 Great Cumberland Place, London, W.1, for permission to operate helicopter services for the carriage of passengers, freight and vehicles on the routes between Lympne or Lydd and Ostend, Calais, Le Touquet, and Boulogne, if available, for a period of 10 years, commencing 1954, at an eventual frequency of over 100 flights per day on each route. The company propose to operate the helicopter services both as separate services and in support of the vehicle ferry services with fixed-wing aircraft which they are at present approved to operate on the routes between Lympne and Ostend, Calais and Le Touquet. The company propose in the period up to and including 1955, and possibly 1956, to operate only experimental flights and flights for the carriage of freight with Westland S.51 and/or Bristol 171 helicopter aircraft. Thereafter the company propose to operate with a further type of helicopter aircraft to be notified to the Council and advertised later.

APPLICATION No. 302 from British European Airways, of Keyline House, Ruislip, Middlesex, for a helicopter service with Bristol 171 helicopter aircraft for the carriage of passengers, supplementary freight and mail between London Airport and Southampton (Eastleigh), at a frequency of from one to two services daily during the period from June 14th, 1954, to June 13th, 1955.

THESE applications will be considered by the Council under the terms of reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing, stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9 Buckingham Gate, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [2096

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The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

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Vibration Investigation
Failure Investigation
Engine Build Specification Research
Jig and Tool Design
(only senior positions)
Planning
New Process Development
(particularly sheet metal fabrication)
Test Plant Design

Applications should be addressed to:—
CENTRAL PERSONNEL SERVICES,
336-7 Strand, W.C.2.
Quoting reference S.A.30H [2056

PHYSICISTS AND ENGINEERS

ELLIOTT BROTHERS (LONDON) Limited, Guided Weapons Division, requires Physicists and Engineers for research and development work in the North London area. Applicants should possess Higher National Certificate or a degree in Physics or Electrical Engineering. Experience in research, development and design in one or more of the following subjects is desirable but not essential.

(*a*) **Microwave aerials, waveguide components and instruments.**
(*b*) **Radar circuit techniques.**
(*c*) **Electro-mechanical instruments.**
(*d*) **Electric and Hydraulic Servo-mechanisms.**

SALARY will be according to qualifications and experience and senior positions are available. Applications, giving details of age, education and experience, should be made to Personnel Officer, Elliott Brothers (London) Ltd., Elstree Way, Borehamwood, Herts., quoting Ref. 5206. [2073

ARMSTRONG SIDDELEY MOTORS LIMITED

HAVE vacancies for technical assistants for research and experimental work on aircraft gas turbines; particularly on compressors, turbines and aerodynamic flow problems. Engineering degree, H.N.C. or equivalent necessary.—Write, in detail, to Reference G.W.B., Personnel Manager, Armstrong Siddeley Motors, Ltd., Coventry. [2007

HANDLEY PAGE, Ltd., require young flight test observers at their Radlett aerodrome. Applicants should have had experience in this type of work and be educated to degree or Higher National Certificate standard. Good salary and flying pay.—Write, stating age and full relevant particulars to Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.2. [2093

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(a) **TECHNICAL LIAISON ENGINEERS** in the Civil Aircraft Servicing Department. Applicants should be about 30 to 35 years of age, well educated, including an apprenticeship or similar training, and have had some experience on aircraft design.

(b) **FITTER-ERECTORS,** skilled or well-experienced semi-skilled, on aircraft preparation for flight work, etc. Vacancies on both day and night shift exist at our Wisley Aerodrome.

(c) **INSPECTORS,** with "A" licence—preferably in group 5.4—for final aircraft inspection, at Weybridge and Wisley Aerodrome.

(d) **ELECTRICAL WIREMEN,** with some electronics experience, for development work, including radio control.

(e) **FITTER-ERECTORS,** skilled or well-experienced semi-skilled for aircraft repair and service. Applicants will be required to work mainly at Weybridge, but must be mobile for work as necessary in any part of this country or overseas.

(f) **INSPECTORS/VIEWERS** to cover work on aircraft finals and in Machine Shop, Tool Room, Tinsmiths and Sub-assemblies Shops; also to inspect many other branches of production and development work.

(g) **LABORATORY ASSISTANTS** for calibration and maintenance of flight test instrumentation. Applicants should hold O.N.C. in electrical engineering or some similar qualification and have had experience with telecommunications and electronic equipment. Applications from suitable ex-R.A.F. personnel of the Radar Branch, etc., welcomed.

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COMMERCIAL pilot, light types. State experience and salary.—Giro Aviation, Ltd., Southport. [2092
CHIEF estimator required for a company manufacturing aero engines in the West of England.
EXPERIENCE in precision engineering work essential and sheet metal work experience an advantage. A knowledge of M.O.S. technical cost procedure is desirable.
AGE preferred, 35-45 years.
APPLICATIONS, which will be treated in the strictest confidence, should give details of previous experience and positions held, together with salary required, and should be addressed to The Personnel Manager, Box No. 1NF3735, A.K. Advg., 212a Shaftesbury Ave., London, W.C.2. [2099
URGENTLY required: riggers, fitters for Meteor, Hornet, Mosquito aircraft. Preference given to ex Fleet Air Arm. Also radio mechanic for above types. APPLY: Chief Engineer, Airwork Limited, R.N.A.S., St. Davids, Pembs. [2095
STARWAYS, Ltd., have an immediate vacancy for a fully qualified Dakota captain. A.L.T.P. essential. —Apply, Liverpool Airport, Liverpool 19. [2052
AIRWORK GENERAL TRADING Co., Ltd., require a licensed engineer with "A" and "C" Licences on Dakota aircraft for services in Aden.
APPLICATIONS should be made in writing, giving details of past experience, etc., to the Service Manager, Airwork General Trading Co., Ltd., Blackbushe Airport, nr. Camberley, Surrey. [2020
SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT, Ltd., have vacancies for the following qualified engineers for flight trials work on guided missiles:—
(1) Electronic engineers with University degree or equivalent qualification. Experience on electronic experimental work or Service experience on radio or radar is essential. Age limits 27-38 years.
(2) Mechanical engineer with experience on vibration testing or similar work.
APPLICATIONS giving particulars of qualifications and experience should be addressed to: The Chief Engineer, Armaments Division, Sir W. G. Armstrong Whitworth Aircraft, Ltd., Baginton, Coventry. [2003
METHODS and estimating engineer required for planning and contracts dept. Tool making and costing experience essential. Aircraft experience. Sussex coast. Box 5507. [2080
"A" and "C" engineer required, preferably with Prince licences, but training facilities offered. Work calls for periods overseas. Good overseas rates.—Apply Box 5286. [2021
SENIOR draughtsmen with hydraulic experience required urgently.—Write, giving full information, to Personnel Manager, The de Havilland Aircraft Co., Ltd., Airspeed Division, Christchurch, Hants. [2069
TECHNICAL Assistant required, age 20-25, H.N.C. or equivalent, for interesting work in Heat Exchange Test Dept. Apply, giving age, experience and salary required to Delaney Gallay Limited, Vulcan Works, Edgware Road, Cricklewood, N.W.2. [2100
SENIOR and intermediate design draughtsmen, with good experience of aircraft or light structural or mechanical engineering, required for aircraft and armament project work.—Apply, by letter, to Portsmouth Aviation, Ltd., The Airport, Portsmouth. [0612
CHRISTCHURCH. Urgently required by The de Havilland Aircraft Co., Ltd., Airspeed Division, Christchurch, Hants, senior aircraft draughtsmen with air conditioning experience preferred.—Write, giving full particulars, to Personnel Manager. [2070
MAINTENANCE engineer with "A" licence endorsed for Yorks and Dakotas, required for duties at Stansted Airport.—Apply Chief Engineer, Scottish Airlines, Stansted Airport, Essex. Telephone: Bishop's Stortford 1200, extension 68. [2094
A VACANCY exists in a newly-equipped aerodynamics laboratory for an aerodynamicist, a physicist and a mathematician to work on problems at supersonic air speeds over a wide range of Reynolds numbers.—Please write, quoting Ref. ACJF to Box 5365. [2091
SENIOR and intermediate design draughtsmen urgently required, with experience on mechanical and precision engineering, for development work. Pleasant working conditions. 5-day week.—Apply, in writing, to Personnel Manager, Flight Refuelling, Ltd., Tarrant Rushton Airfield, nr. Blandford, Dorset. [2043

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E. K. COLE, Ltd., Malmesbury Division, require a mechanical engineer of degree of Higher National Certificate standard for work on radar scanners and similar projects. Knowledge of aircraft stressing methods an advantage.

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HELLIWELLS, Ltd., require an "A" licensed radio engineer at their Birmingham Airport base. The appointment is permanent and offers good prospects. Experience should include modern airline equipment. Applications in writing to Service Manager at Birmingham Airport. [2087

SENIOR draughtsman required with comprehensive experience of fuel and oil systems to initiate and take charge of section. Good welfare facilities including staff pension scheme.—Applications, in writing, to the Personnel Manager, Hunting Percival Aircraft Ltd., The Airport, Luton, Beds, stating age, experience and salary required. [2049

TECHNICAL illustrators (male, senior) required. Considerable practical experience of illustrating for sales brochures and descriptive manuals essential. Good welfare facilities including staff pension scheme.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0592

HANDLEY PAGE (Reading), Ltd., The Aerodrome, Woodley, Reading, have vacancies in their design office for senior and intermediate draughtsmen and weightsmen. The work is on an interesting new project and there will be scope for rapid advancement to suitable applications.—Please send full particulars of experience, etc., to the Personnel Officer. [0235

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [0420

H. M. HOBSON, Ltd., Hobson Works, Fordhouses, Wolverhampton, require a number of technicians for interesting development work on power-operated flying control, hydraulic systems, and fuel metering systems. Preference will be given to applicants having previous experience of hydraulic systems, or to those of engineering degree or H.N.C. standard.—Apply, stating age, experience and salary required. [2029

AN aircraft company near Southampton has a vacancy for a male assistant for chemical laboratory work, dealing with the analysis of metals and electro plating solutions, etc. Minimum qualifications A.R.I.C. This is an interesting and progressive post and preference will be given to a young man over the age of 21. Applications, stating age and full details of experience, to the Personnel Manager, Folland Aircraft, Ltd., Hamble, Hants. [2075

AN aircraft company near Southampton have a vacancy for a machine shop estimator. Applicants must possess a fully comprehensive experience of modern machine shop production methods and estimating procedure, and be capable of own processing. Applications, stating age and full details of experience, to the Personnel Manager, Folland Aircraft, Ltd., Hamble, Hants. [2076

ANGLO-IRANIAN OIL COMPANY has a vacancy at its head office in London for an assistant aeronautical engineer with experience in aircraft or aero-engine design and development. The post will entail liaison with aircraft industries with particular reference to the problems associated with the operation of fuel, lubricating oil and hydraulic systems in aircraft. Applicants should be between the ages of 25-32 and possess either an engineering degree or A.F.R.Ae.S. Salary according to age, qualifications and experience. Write, stating age, qualifications and experience, to Box 6687 c/o 191, Gresham House, E.C.2. [2082

MINISTRY of Supply, R.A.E., Rocket Propulsion Dept., Westcott, Bucks, requires: Engineers and Physicists to assist with testing and development of rocket motors and fuels, and recording of rocket motor performance. Research on rockets covers a wide and varied field, including theoretical as well as experimental work. Qualifications: Higher School Cert. (Science) or equivalent, but further training in physics or engineering to H.N.C. or degree standard may be an advantage. Appointments graded according to age, experience, etc., within range, Experimental Officer (min. age 26) £690-£850, or Assistant Experimental Officer £276 (age 18) £615. Women somewhat less. Appointments unestablished, application forms from M.L.N.S. Technical and Scientific Register (K), 26 King Street, London S.W.1. quoting C 333/54A. Closing date: June 11, 1954. [2074

BRITISH WEST INDIAN AIRWAYS require two aircraft and accessory overhaul inspectors on direct contract for three years. Essential qualifications are aircraft maintenance engineer's licence valid in category "A" for Dakota and Viking, and category "C" for Hercules 630 Series and Pratt and Whitney R.1830 Series; also at least five years' experience on aircraft maintenance and overhaul, of which one year must have been on inspection. Viscount experience is an added advantage. Salary $372 to $464 per month, according to experience and qualifications. Successful candidates will be required to join the Company's Provident Fund. Application in writing to Staff Manager, Subsidiaries, British Overseas Airways Corporation, Airways House, Great West Road, Brentford, Middlesex. [2086

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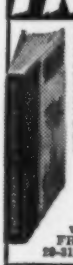

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SENIOR technical assistant required for wide variety of design problems on aircraft and guided missiles. Pleasant working conditions. Superannuation scheme after qualifying period.—Apply, Chief Designer, The Heston Aircraft Co., Ltd., Heston Airport, Hounslow, Middx. Tel.: Hayes 3844. [2006

DRAUGHTSMAN required for work on aircraft components. Experience in the aircraft industry desirable, but not essential; good mechanical engineering draughtsman will be considered. Capable of working with the minimum of supervision. Write, giving particulars of age, experience and technical qualifications, to: King Aircraft Corporation, Fifth Street, Montrose Avenue, Hillington, Glasgow, S.W.2. [1933

ARMSTRONG SIDDELEY MOTORS, Coventry, have vacancies for a number of designers and senior and junior draughtsmen. Although gas turbine experience is most advantageous it is not necessarily essential as training will be given in this specialized work to suitably qualified draughtsmen.—Apply, in detail, to Reference F.103, Personnel Manager, Armstrong Siddeley Motors, Coventry. [0200

AIRFRAME stressmen are required for a design office in the south of England and salaries of £800 to £1,000 per annum are offered to applicants with six to 10 years' experience, and to those with three to five years' experience, £13 to £15 per week.—Please send particulars of experience, qualifications and age, stating whether married, to Box AC88922, Samson Clarke, 57-61 Mortimer Street, W.1. [0236

SENIOR and intermediate stressmen required by the de Havilland Aircraft Co., Ltd., Airspeed Division, Christchurch (nr. Bournemouth), Hants, for interesting structural analysis on supersonic aircraft. Past experience of aircraft stressing would be advantageous, but not regarded as essential for intermediate work. Minimum qualifications required are B.Sc., H.N.C. or equivalent. PLEASE write stating age, experience and training, and also salary required to the Chief Stressman. [2085

JIG and tool draughtsman (senior) required. Good welfare facilities including staff pension scheme.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0593

PAKISTAN INTERNATIONAL AIRLINES invite applications from flight engineers for Super Constellation aircraft. Experienced purser stewards and hostesses for multi-engine aircraft on overseas routes also required. Please apply in writing to the General Manager, c/o Pakistan High Commission, 35 Lowndes Square, London S.W.1. [2081

MINISTRY OF SUPPLY requires scientific officers for project assessment group at London Headquarters. Quals.: 1st or 2nd class honours degree or equivalent in physics, maths. or eng. Taste for broad assessment work leading to selection of aircraft and other equipment for military and civilian use desirable; some practical design experience an advantage. Salary within range £470-£855. Women somewhat less. Appointments unestablished. F.S.S.U. benefits may be available. Application forms from M.L.N.S., Technical and Scientific Register (K), 26 King Street, London S.W.1, quoting A135/54A. [2083

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THE Supermarine Works of Vickers-Armstrongs, Ltd. require men with a degree, Higher National Certificate or an equivalent qualification for technical posts concerned with development flight testing of fighter aircraft. Experience of similar work would be an advantage.—Apply, in writing, to Personnel Department, Hursley Park, nr. Winchester. [2061

SEVERAL senior draughtsmen with experience of turbine engine installations required immediately for both fixed and rotating wing installations. Good welfare facilities including staff pension scheme.—Applications, in writing, to the Personnel Manager, Hunting Percival Aircraft Ltd., The Airport, Luton, Beds, stating age, experience and salary required. [2048

CITY OF MANCHESTER: Fire Officer, Manchester Airport. Applications are invited from suitably qualified persons for the above post at a salary in accordance with Grade APT VIII of the National Joint Council Salary Scales (£785 x £25—£860). The commencing salary will be fixed according to qualifications and experience of the person appointed. Further details, together with form of application may be obtained from the Airport Manager, Manchester Airport, Wythenshawe, Manchester, on receipt of a stamped addressed foolscap envelope and should be returned to the same address by June 12, 1954. Canvassing is prohibited. [2089

A. V. ROE AND COMPANY, Ltd., have vacancies in their newly formed electronics laboratory for technicians who would be occupied on work in connection with the development of electronic computing equipment for use in the design office. The electronics department is expanding and is likely to take in many diverse fields of development. Candidates should possess a degree in physics or electrical engineering and preference will be given to applicants who have had some practical experience. Applications, stating full details of age, qualifications and experience should be addressed to the Labour Manager, A. V. Roe and Company, Ltd., Greengate, Middleton, Manchester. [2078

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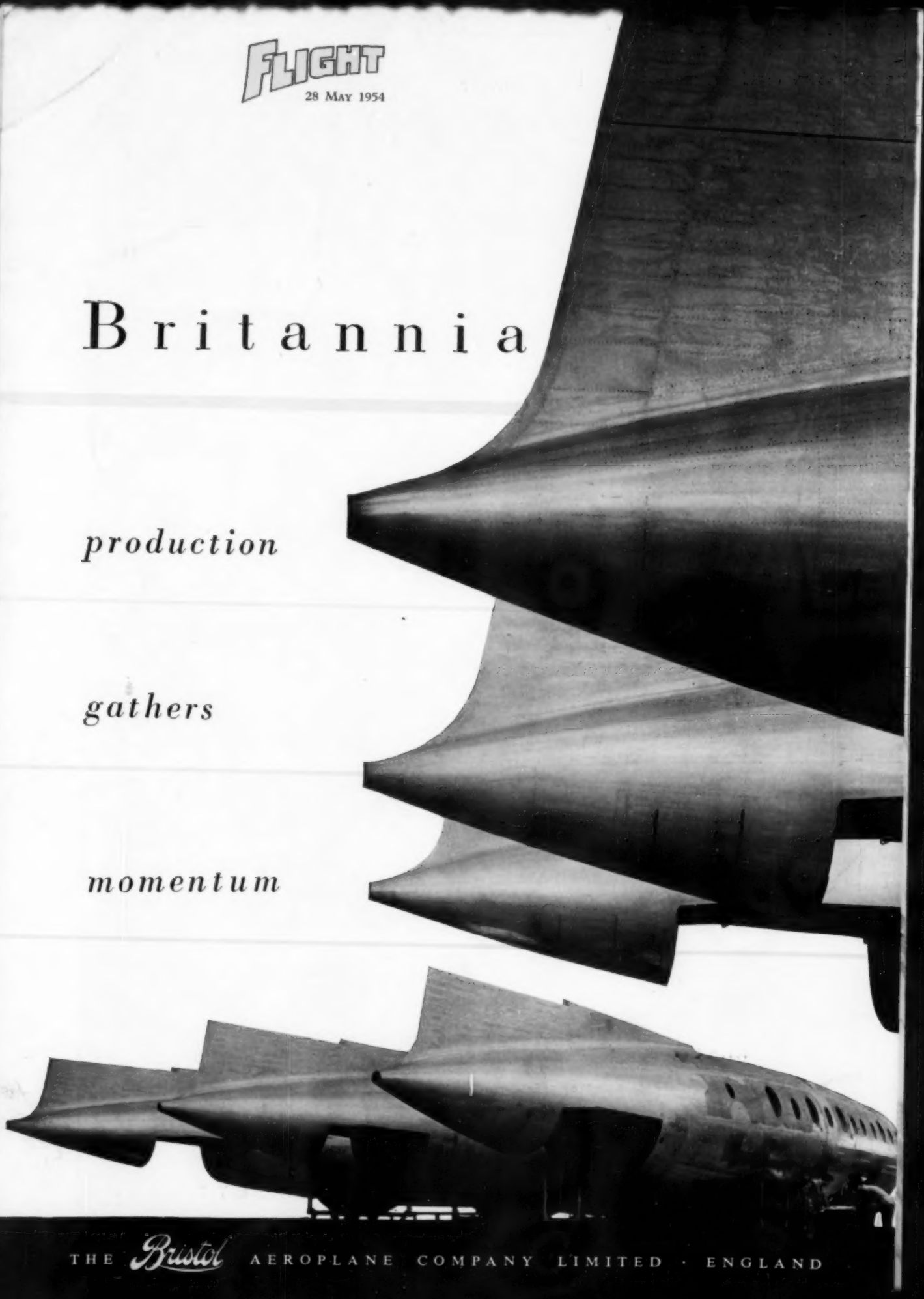

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